World Petroleum

AUGUST, 1949

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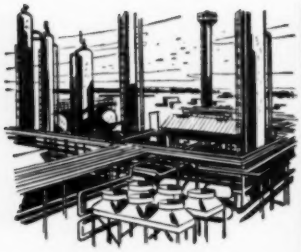
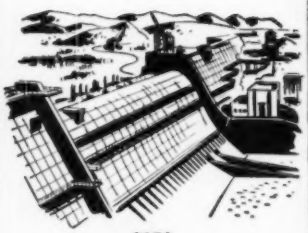
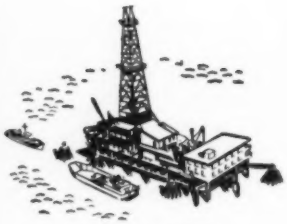


GASOLINE PLANTS



DAMS

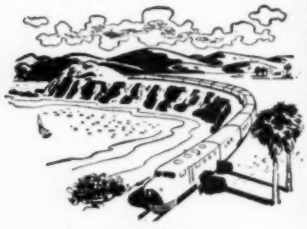


OFFSHORE PLATFORMS

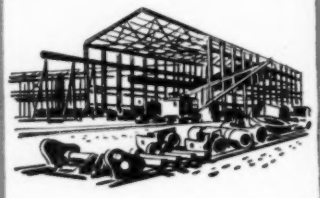
BRIDGES

YOUR PROBLEM IS OUR PLEASURE

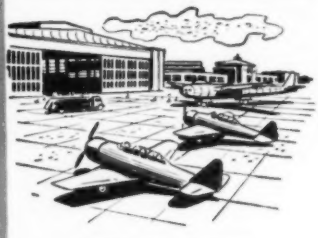
HIGHWAYS



RAILROADS



CHEMICAL PLANTS



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Brown & Root, Inc., prides itself on an organization that has met and vanquished the problems surrounding nearly every type of heavy construction. Experience is a stern but thorough teacher, and discoveries made on one project save other clients much time and many dollars.

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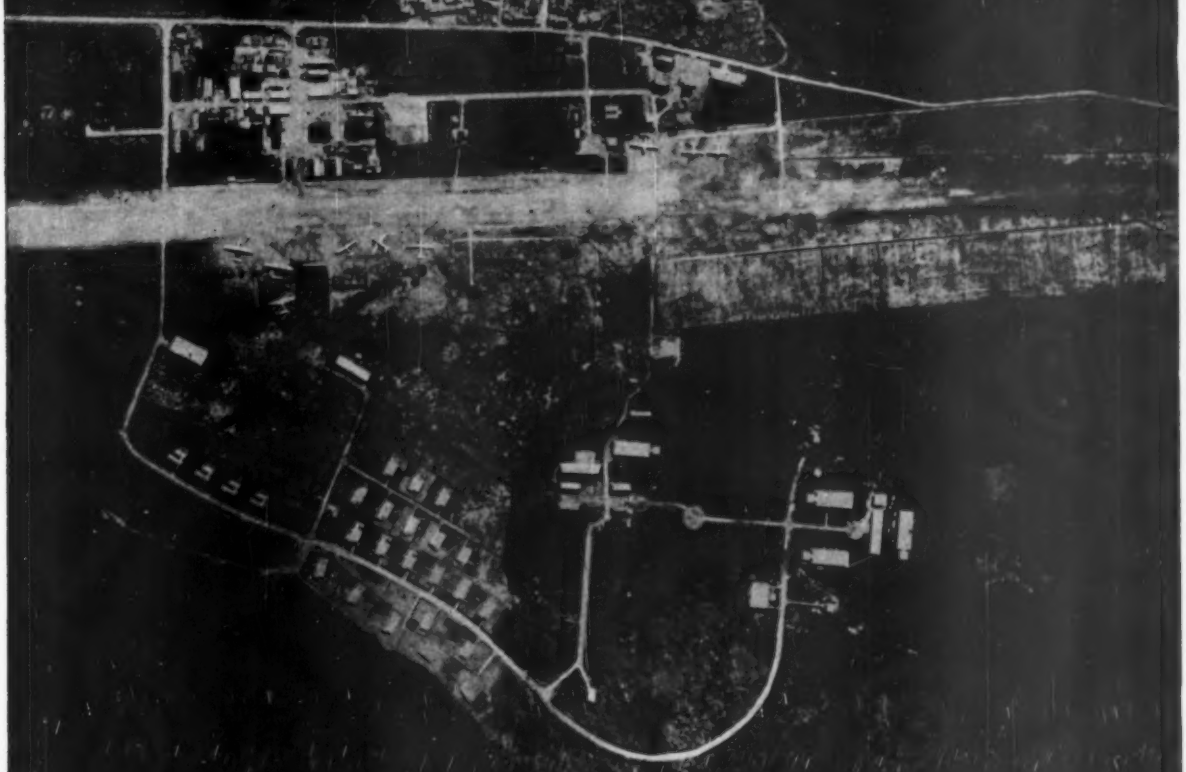

To no single industry does the use of aircraft present such revolutionary possibilities as it does to oil drilling. Remotely sited or inaccessible workings can be reached in minutes or hours instead of days or weeks. Air transport for key technicians and urgently needed spares reduces production hold-ups to a minimum. Speedy despatch of medical supplies, availability of air ambulance services, establishes close touch with civilization. Daily supplies of hitherto unobtainable fresh foods, by maintaining fitness, increase output. Surveys and inspections are completed in a fraction of the time. In short, air transport by very considerably reducing the all important time factor when applied to "key" problems, increases output and, where weather is a limiting factor, may increase the number of working days. *In some cases, even one light aeroplane would serve the purpose!* But air transport, when reliable and economical, is a science in itself, whether for a fleet, or for a single aircraft. In whatever part of the world, Airwork Limited can provide the organisation for efficient and economic operation of your own air transport. Airwork Limited, the founders of Heston Airport, are the largest British Air Transport Contractors specialising in these problems since 1929.

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OCTOBER 16th-22nd proclaimed OIL PROGRESS WEEK!

Here's what YOU can do to make the most of this special occasion!

DURING THE WEEK OF OCTOBER 16th-22nd, your community's attention will be focused on the oil industry! For that's the date of Oil Progress Week—the week that gives you a chance to report the progress you and your industry have made.

Last year, Oil Progress *Day* gave thousands of oil men across the country a great chance to tell their story—and they did—with results that paid off handsomely in good will and good business. This year, with an entire *week* devoted to the event, you've got an even greater opportunity to explain how your firm is helping to provide America with *better*, more efficient oil products . . . higher standards of service.

You're the One Who Gains!

YOU gain when your customers understand the competition in oil—the way you compete with rival companies to win customer approval. For as the public learns what a great job you're doing, they'll understand why your business freedom means *more* oil products, *better* oil products, better service for *them!*

Get Ready For Your Big Week!

Get free material to promote Oil Progress Week from your local O.I.I.C. office. You can adapt it to fit your needs. Tie in ads . . . sample speeches . . . booklets . . . motion pictures . . . employee meeting material . . . poster designs . . . radio material . . . everything you need to make Oil Progress Week *your* week!

Get in touch with your local O.I.I.C. office NOW! Or write to national office address listed below.

OIL INDUSTRY INFORMATION COMMITTEE

——50 West 50th Street • New York 20, N. Y.——

Here's how you can benefit from Oil Progress Week

During Oil Progress Week get people acquainted with your business. That way, your neighbors will get a new understanding of the problems you face . . . an understanding that's *bound* to result in more friends for YOU! Tell them about today's new and better oil products . . . how *hard* you've worked to maintain and step up your high standards of quality and service—and you create good will that pays off for you and your *firm* in the long run!

Get in touch with your district committee *NOW!*

They'll make it easy for you to make the most of Oil Progress Week. They'll give you material you can use to tie in your name and your business with this big nationwide report!

Don't miss this chance to stand out in your community! Make Oil Progress Week Your Week!

Turn your production UP-SIDE-DOWN
Don't let your production of gasoline remain the small end of your refining.
GASOLINE
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Make gasoline your top production item — for greater profits.
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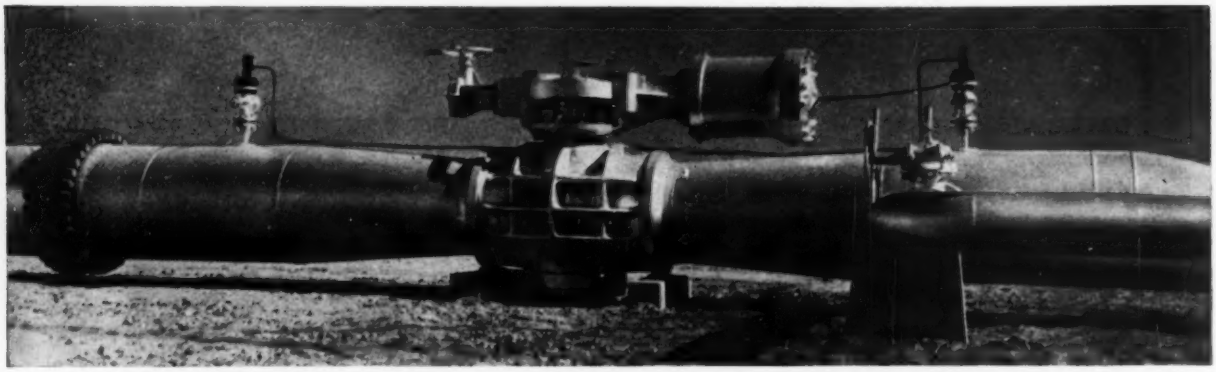
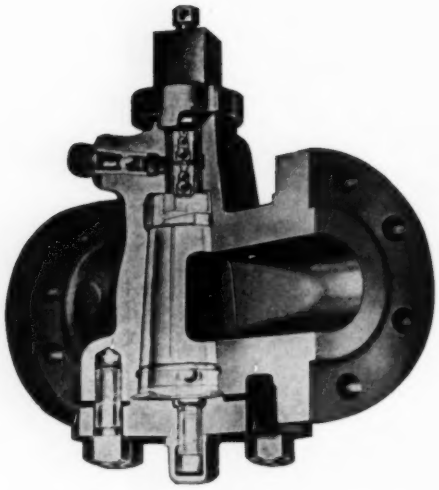


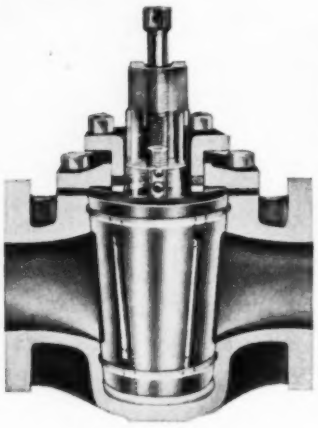
Head off shut-off worries



Hypreseal Type

Pressurized lubrication
Tapered, jackable plug
Unexposed seat
Positive rotary action
Adjustable under pressure
Streamlined passageways

When you want a tight shut-off all along the line you have complete assurance with Audco-Nordstrom valves. You don't have to worry about dust, abrasives or suspensions in the line fluid interfering with valve closure. The Audco-Nordstrom rotary plug, sliding on its protected lubricant seat, closes sleeve-like instead of depending upon an imposed thrust against an exposed seat. Pressurized lubrication surrounding each port prevents leakage internally and externally. This is valve engineering at its best; valve operation so positive, so sure, that no other means of line control can equal it.



Standard Type

AUDCO-NORDSTROM ADVANTAGES INSURE POSITIVE VALVE CONTROL

Uninterrupted operation requires valve dependability. The arteries of any gas or petroleum operation are its flow lines. Top capacity production requires perfect functioning of every line. Audco-Nordstrom valves insure uninterrupted operation; quick, positive shut-off and freedom from hazardous leaks because their inherently sound engineering design has eliminated every valve weakness. Internal lubrication, serving the triple function of facilitating plug rotation, sealing the ports and jacking the tapered plug, is a vital asset that alone makes Audco-Nordstroms the most advanced valves of industry.

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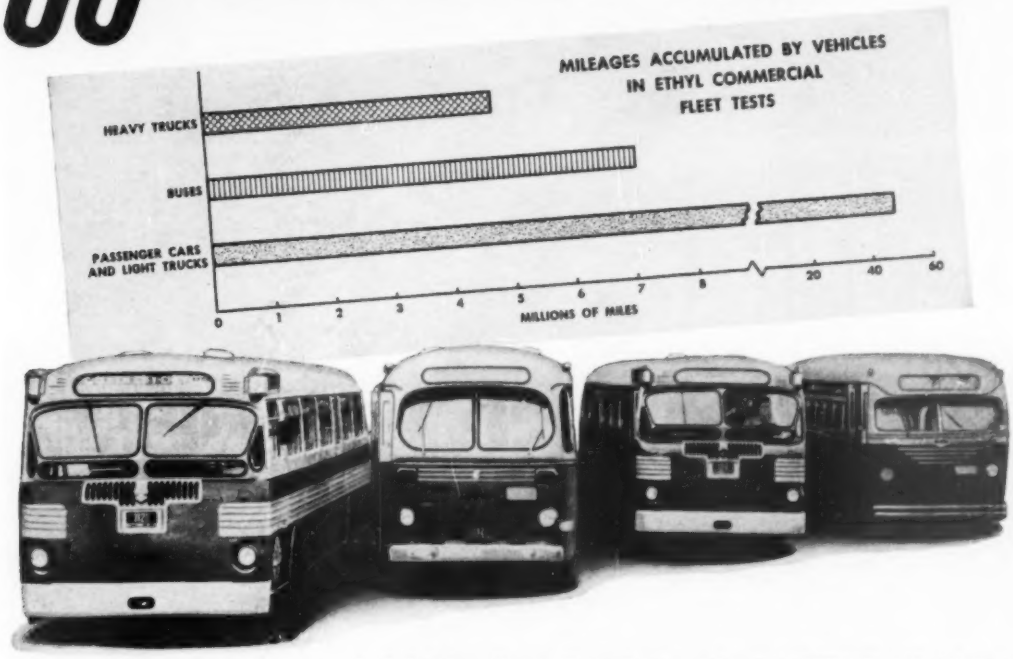
60 MILLION MILES OF FLEET RESEARCH



Cooperative tests, made possible by Ethyl's close relations with automotive companies and operators of commercial fleets, have provided information on more than 60,800,000 miles of road operation. Commercial fleet testing is the final step in Ethyl's extensive research program aimed at developing the best antiknock fluids for the oil industry.

Refiners benefit two ways

In addition to contributing to continually improved antiknock fluids, Ethyl's carefully controlled fleet programs provide refiners two major benefits:

1. **Basic information on the performance of different types of gasolines and oils operating under a wide range of service conditions . . .**

   thus refiners often find it possible to reduce the amount of expensive fleet research necessary to obtain similar basic data.

2. **A fund of information on improved maintenance practices which often point the way to more satisfactory use of petroleum products.**

Although the Laboratories each year conduct thousands of hours of research on single-cylinder engines, on full-scale engines connected to dynamometers, and on Ethyl-owned fleets of passenger cars and trucks at Detroit and San Bernardino, they have never been satisfied to accept the results of any one of these steps as the final answer in the development of "Ethyl" antiknock compounds.

How Ethyl fleet research is conducted

Ethyl commercial fleet tests are planned to be representative of the types and makes of vehicles in production, the variety of loading and operating schedules normally employed, and the weather and topographical conditions encountered in service in different parts of the country. Comprehensive control of each cooperative program is the responsibility of an experienced Ethyl engineer. He works out the details of the test with the management of the fleet and makes certain that procedures and controls provide reliable data . . . without introducing changes in the operation which would destroy the usefulness of the fleet as an index of commercial operation.

Since 1923—*continuous research to provide better antiknock service*

ETHYL CORPORATION

RESEARCH LABORATORIES

Detroit, Michigan, 1600 West Eight Mile Road • San Bernardino, California, 2600 Cajon Road

·N.B. While it is axiomatic that return on investment—the *ultimate earning power* of a refinery unit when actually on stream—is the only true evaluation of competitive engineering recommendations, initial plant costs remain a major factor in refiners' decisions on plant installations. M. W. Kellogg takes specific steps to *minimize initial plant costs* consistent with the achievement of *highest ultimate earning power*.

NOW—PRE-CAST WALLS THAT SAVE OVER 35%

Nearly everyone is familiar with the astronomical heights to which the costs of brick refinery buildings have risen. Some efforts have already been made to find lower costs methods. Among these is the use of concrete blocks, but this type of construction has the decided disadvantage of low structural strength to support equipment. Poured concrete walls remedy this defect but again prices soar because of tailor-made form work.

Seeking an economical solution to this problem, Kellogg's engineering and construction departments combined their efforts. They eventually arrived at a design that not only overcomes such disadvantages as low structural strength, but *saves upwards of 35% of the cost of brick buildings*. Moreover this new technique has a further advantage in that the buildings can be closed in a fraction of the time required for other types, thus permitting interior work to proceed regardless of weather.

Kellogg's concept isn't unusual, but the application is. Several recently completed large steel frame buildings and reinforced concrete super-structures were designed so that entire wall sections could be precast—*complete* with all door and window frames as well as conduit, duct and pipe inlets in place. Poured at the same time as the foundations, wall sections cure simultaneously and cranes can then lift them into position in a matter of minutes. The result: Modern, industrial housing with low maintenance and high functional value at radically lower costs.

This is another example of how completeness of staff and integration of operation benefit the refiner. Such attributes are the result of size, and of wide experience in both technical and managements phases. The M. W. Kellogg Company believes that such an organization is the only true approach to LOW INITIAL COSTS.

THE M. W. KELLOGG COMPANY

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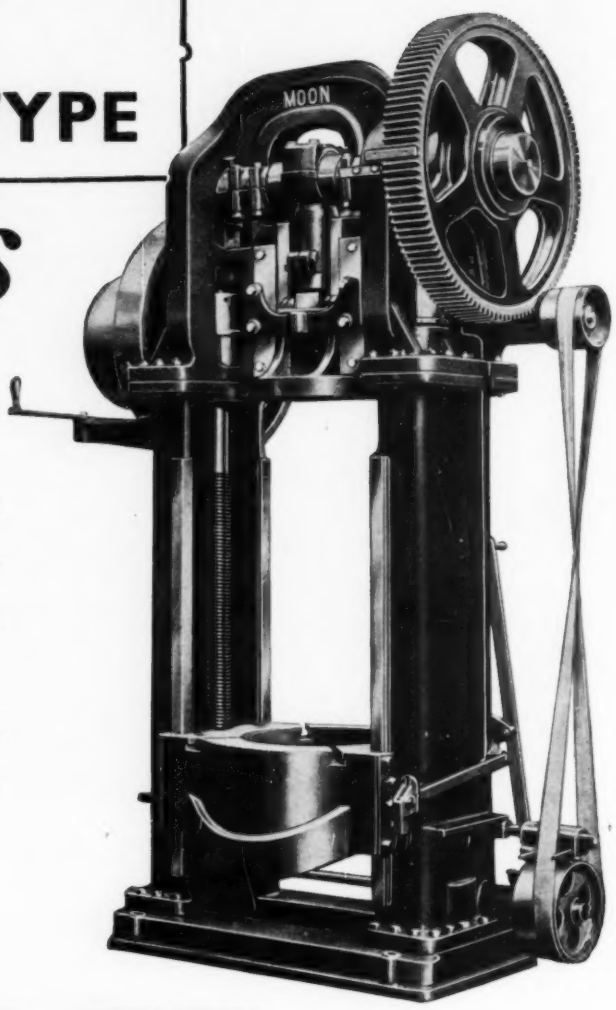
CURLING PRESS

for OPEN TYPE *Drums*



This is a machine designed primarily for curling the open tops of returnable drums, but will also accommodate standard dies, thus spreading the initial cost over a larger field of utility.

The head or superstruction contains all the features of a normal press and includes a safety fuse for heavy die work.

MOON

Regd. Trade Mark

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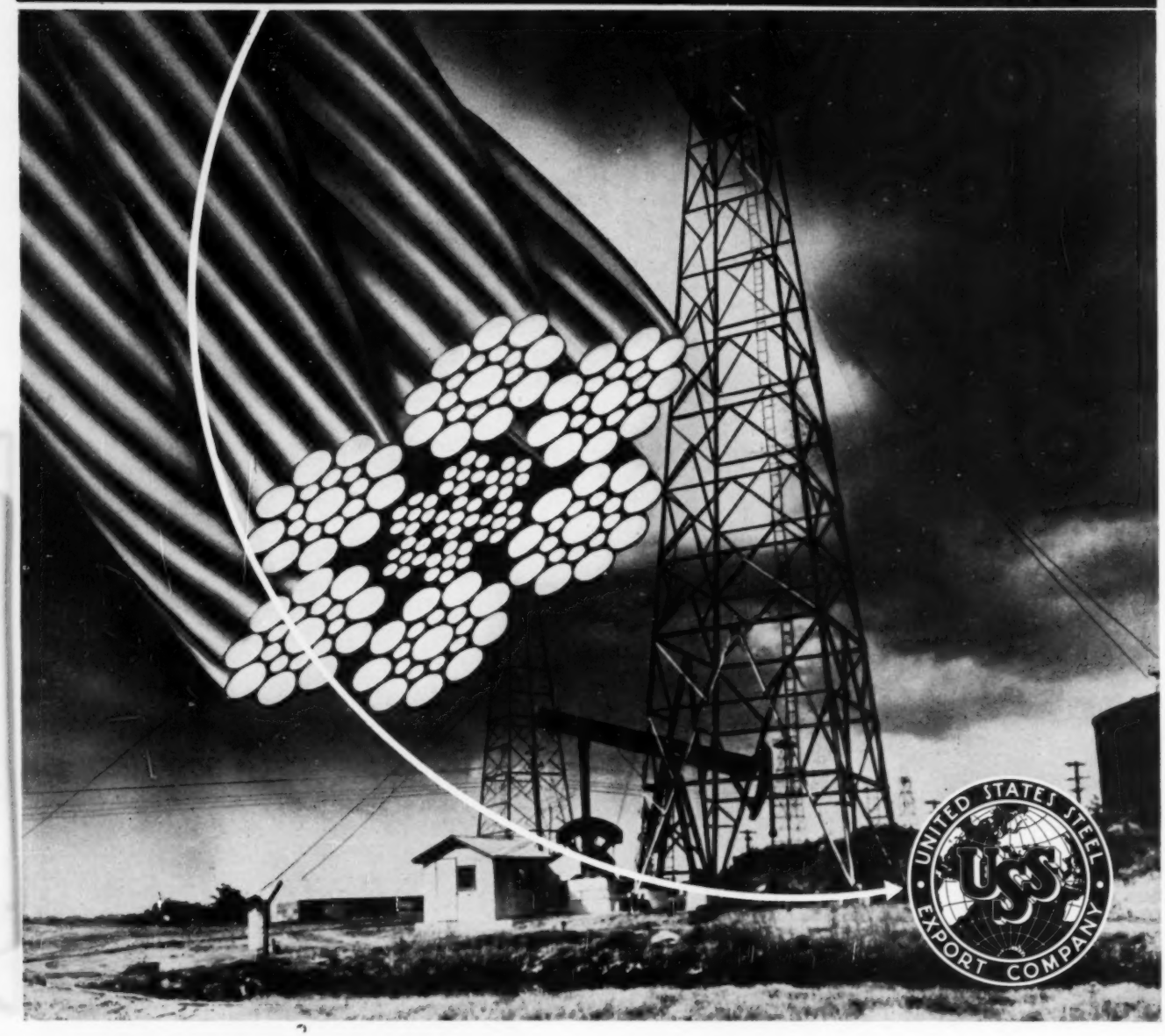

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for smoother performance and longer life at lower cost

Here's good news for oil men the world over. U·S·S Tiger Brand Excellay Preformed Wire Rope—famous for its ability to meet the exacting demands of all types of oil well usage — is available again!

Made to close tolerances from uniformly high-quality steel wire, U·S·S Tiger Brand Wire Rope provides the right combination of strength, toughness and flexibility needed for trouble-free drilling operations. It goes as deep and as fast as necessity demands.

U·S·S Tiger Brand Excellay Preformed offers you other advantages, too. It's more supple; easier and safer to handle. It has less tendency to kink or snarl because each strand is pre-shaped to the position it takes in the finished rope.

For smoother performance and longer life at lower cost, ask your nearest distributor for U·S·S Tiger Brand Wire Rope.

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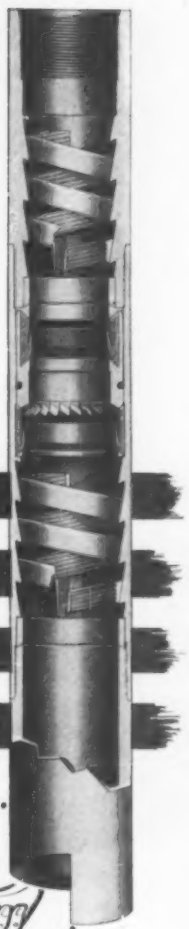
"data for the doghouse"

on BOWEN RELEASING AND CIRCULATING OVERSHOTS



EASY FISH ENGAGEMENT

FULL NON-CRUSHING "GRAPPLE GRIP"

INSTANT RIGHT-TORQUE RELEASE WHEN READY

FULL TIME, HIGH-PRESSURE CIRCULATION

HERE'S A TOOL that gives you every advantage for quick recovery of fish to be externally engaged. Without adjustment it catches drill pipe—coupling *or* tool joint, whichever is up! And not only grips the fish in a patented non-crushing "grapple grip" that tightens as pull increases, but this Bowen Releasing and Circulating Overshot automatically mills and conditions jagged ends of the fish to permit full pack-off for high pressure circulation through the fish. A Bowen Releasing and Circulating Overshot is your best insurance against excessive lost time in the event of a twist-off—have one handy on your next well!

HERE'S HOW IT WORKS

TO ENGAGE THE FISH you need only connect the Bowen Overshot to the fishing string and run-in to the top of the fish. At this point, rotate right and let down until the fish enters the Overshot. For jagged ends of pipe, rotate slowly to the right as you gradually lower the fishing string. This allows the cutters to mill the jagged ends of the fish for full positive engagement and better seal when circulating. Once the Overshot is settled securely over the fish, neutralize the torque and pull up on the fishing string.
TO RELEASE FROM THE FISH drop the weight of the fishing string heavily against the Overshot. Then at the same time lift and rotate the fishing string to the right. This expands the spiralling grapple and permits easy pull-away from the fish.
TO CIRCULATE AND ROTATE when the fish does not come free on a straight pull, start circulation and while maintaining an upward pull, rotate *violently* as much as the fishing string will stand. The Bowen Releasing and Circulating Overshot is ruggedly built to withstand the toughest fishing jobs!

AND HERE'S THE REASON WHY

When a Bowen Releasing and Circulating Overshot is rotated to the right and lowered over the fish, drag of the fish against the bore of the grapple causes it to unwind and expand sufficiently to allow the fish to enter. As upward pull is exerted, the spiralling grapple is contracted by the tapers in the bowl to wedge and set the deep cut wickers about the entire circumference of the fish. The pipe grapple or the tool joint grapple grips firmly and evenly over a large area of the fish in much the same manner that the "Chinese Handcuff," illustrated at right, tightens when pull is exerted. As pull is increased, the grapple tightens about the fish and the greater the pull, the tighter the grip *without distortion* to the fish!

The Bowen "Grapple Grip" Principle.

MORE "DOGHOUSE DATA" WILL APPEAR REGULARLY—WATCH FOR IT OR CONTACT YOUR S. R. BOWEN REPRESENTATIVE

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To meet the growing power demands of industry, General Electric Company retained Stone & Webster Engineering Corporation to design and construct at Schenectady, New York, its new turbine manufacturing plant.

The building, which is 650 feet wide by 1290 feet long, has a total floor area of more than 1,000,000 square feet. It required foundation construction of unusual design to carry the heavy loads to be superimposed on the manufacturing floor, which comprises nearly 20 acres.

This plant when in full production will be capable of producing each month enough turbine-generators to supply power and light for a city of a million inhabitants.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

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BIG DERRICKS
TO DRILL
THE
WORLD'S
DEEPEST
WELLS

This Big SuperKAY Derrick on the world's largest rig, is 192 feet from base to top plate, measured up the leg. It is designed for drilling beyond 20,000 feet, and proved itself in operations which produced the world's deepest hole. For deeper well drilling, specify Lee C. Moore SuperKAY Derricks.

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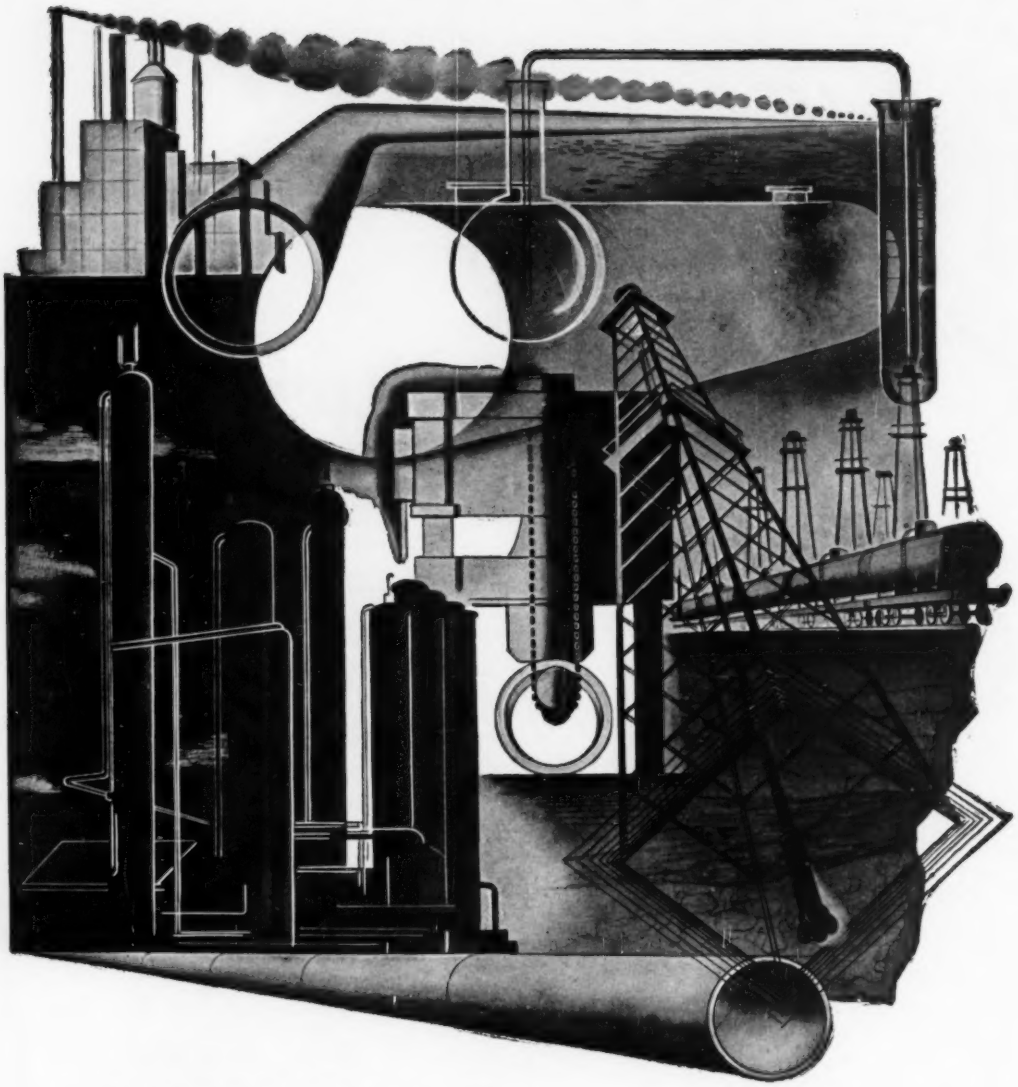

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THE UNITED STEEL COMPANIES LTD

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IN SOCONY-VACUUM'S OPERATION,
these major steps—from exploration to delivered product—are carefully co-ordinated to assure maximum efficiency all down the line, maximum savings for you.

First, find the oil—
To satisfy the growing demand, we must maintain a *constant search for new oil*. This in spite of the fact that we purchase large amounts of our crude oil needs from independent producers.

Then drill for it—
Even after oil is found, development of the field entails great cost. New wells must constantly be drilled to replace depleted wells—and so maintain petroleum supply.

Transport it to refinery—
Although we use other common carrier pipelines for transportation, in 1948 Socony-Vacuum laid 3,000 miles of *new* pipelines needed to reach new fields and improve distribution.

Refine it—
by the latest and most up-to-date processes, *geared for high capacity output*. Oil refinery equipment, by the way, which cost the company around $500 a barrel of capacity before the war, now costs $1,000.

Distribute it—
While we own and operate many ships, we also charter vessels and tank cars—rely on common and contract haulers. The combined result—maximum efficiency, lower cost to you.

And finally serve it—
Besides direct distribution, efficiency dictates the use of *over 1,400 independent wholesalers* and some *45,000 independent dealers* to whom of course we give expert technical and marketing counsel.

A STRONG NATION depends on strong Industries . . . strong Industries depend on strong Companies.

Socony-Vacuum — or any Company in America — is only as strong as its ability to *compete efficiently* in serving you . . .

. . . with productive power to help build National Security . . . with quality products at low prices to make your dollars buy more.

The Benefits of Competitive Efficiency:

LOW PROFIT PER UNIT—THE MOST FOR YOUR PETROLEUM DOLLAR!

SOCONY-VACUUM

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

The Maxim-Air Window

Particularly adapted for use in warm climates where it is important to provide a free circulation of air in any weather. All ventilators are top-hinged to open out; they are mechanically controlled and open or close simultaneously.

Casement Windows

Truscon Residence Casements are equipped with Roto Operators which open or close the ventilators without the necessity of moving the screen. Ventilators are held securely in any open position. As in the case of all Truscon windows, casements are Bonderized.

Intermediate Combination Windows

Side-hinged casements and projected ventilators incorporated in one design. Unusual flexibility of ventilation during inclement weather. Ideal for hospitals, offices, and public buildings.

Experienced Workmanship and Finest Materials Make Truscon Steel Windows Weathertight

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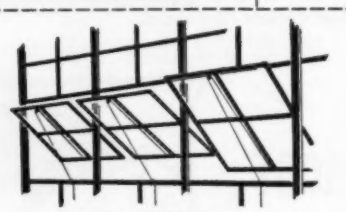

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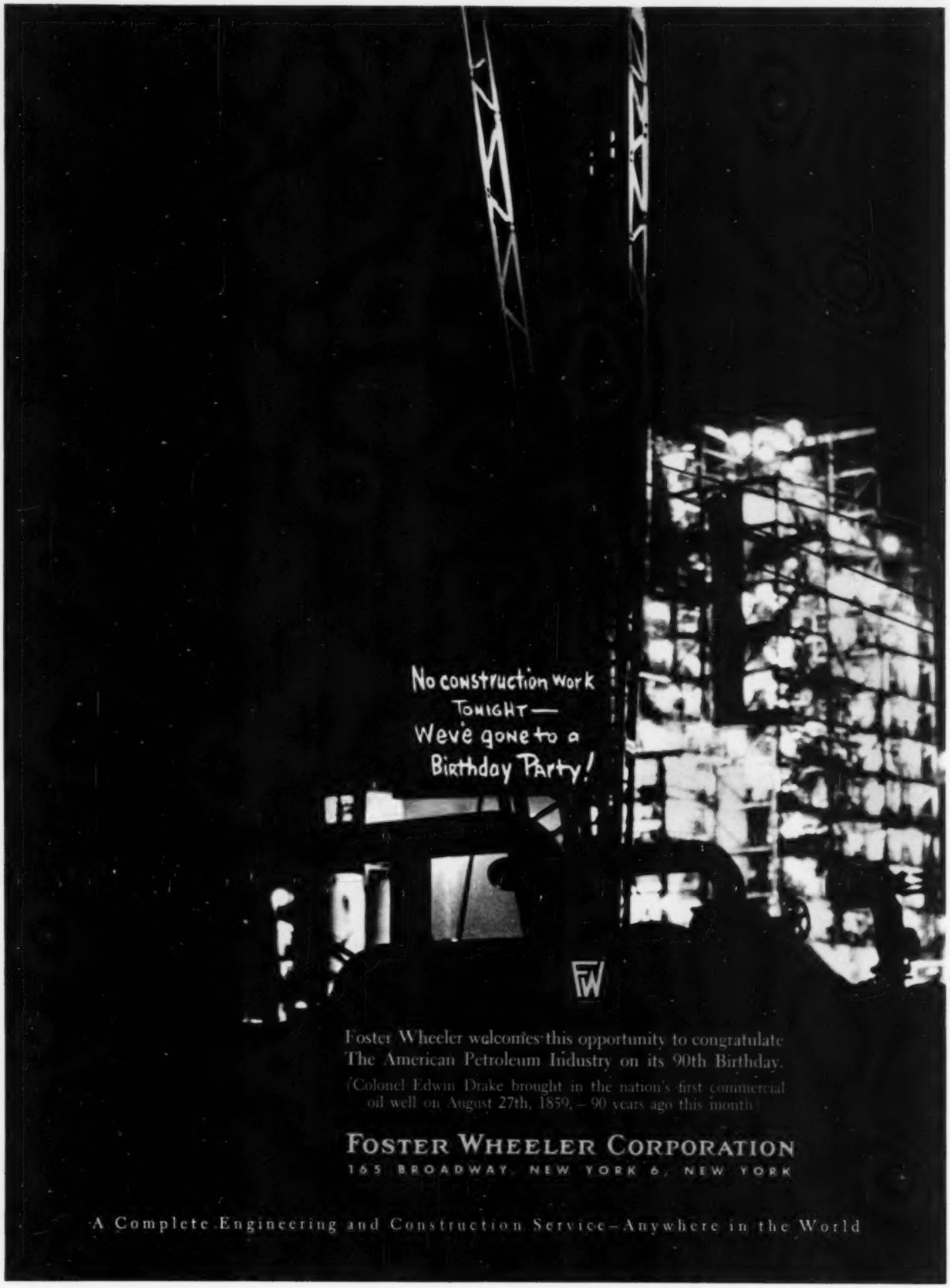

Foster Wheeler welcomes this opportunity to congratulate
The American Petroleum Industry on its 90th Birthday.

(Colonel Edwin Drake brought in the nation's first commercial oil well on August 27th, 1859, – 90 years ago this month)

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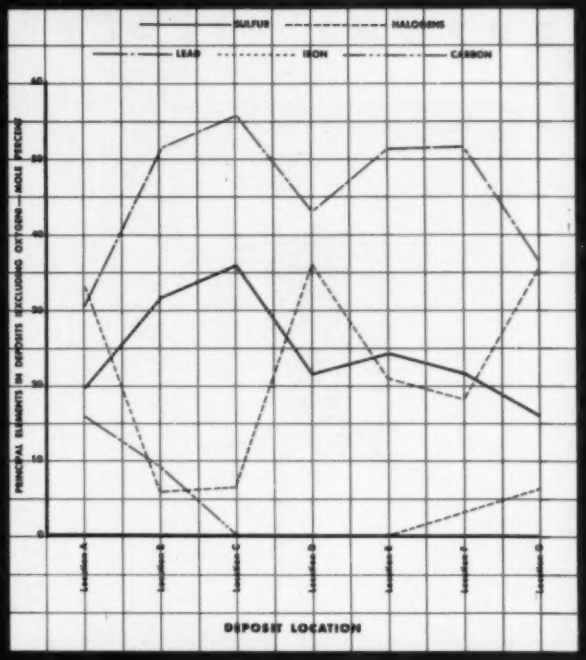
Investigating Engine Deposits for their effect on Fuel Performance

All liquid fuels burned in internal combustion engines produce combustion chamber deposits, the composition of which will vary with the hydrocarbon composition of the fuel, the type of lubricating oil and the presence or absence of tetraethyl lead. Investigation into the composition of deposits from leaded gasolines has shown that in addition to simple compounds they consist of complex mixtures of compounds. Among those definitely identified to date are the eleven listed below.

The most modern X-ray diffraction apparatus and other specialized equipment is used in the analysis of deposits, identifying the different compounds formed under various operating conditions and at various locations within the engine.

This is research upon specific and recognized problems working toward answers which will benefit the entire industry.

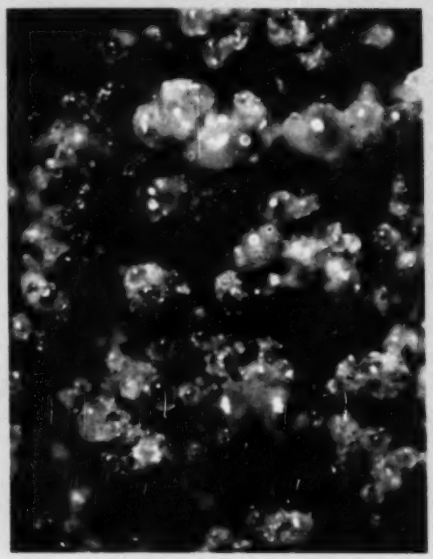
VARIATION IN COMPOSITION OF DEPOSIT WITHIN COMBUSTION CHAMBER OF LABORATORY TEST ENGINE



DEPOSIT COMPOSITION

The following lead compounds are some that have been identified to date in combustion chamber deposits in addition to those contributed by the base fuel and lubricating oils.

PbO
$PbSO_4$
$PbSO_4 . PbO$
$PbSO_4 . 2PbO$
$PbSO_4 . 4PbO$
$PbBr_2$
$PbCl_2$
$PbBr_2 . PbCl_2$
$PbBr_2 . 2PbO$
$PbCl_2 . 2PbO$
$PbCl_2 . PbO$



Photomicrograph of deposit from piston top.

Photomicrograph of deposit from intake valve stem.

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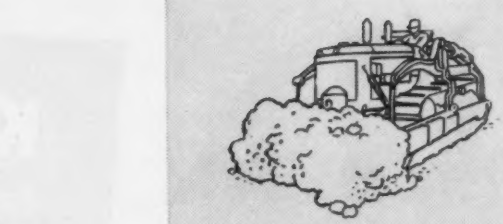

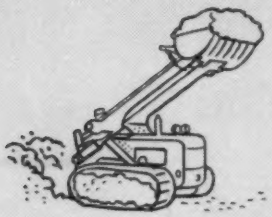

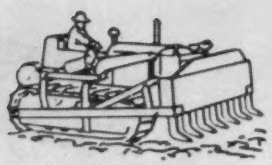

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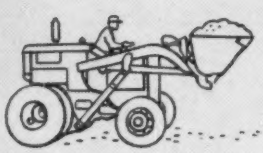

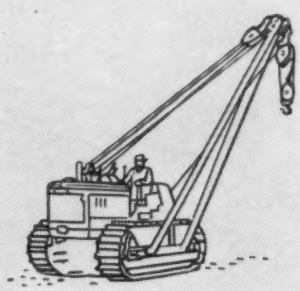

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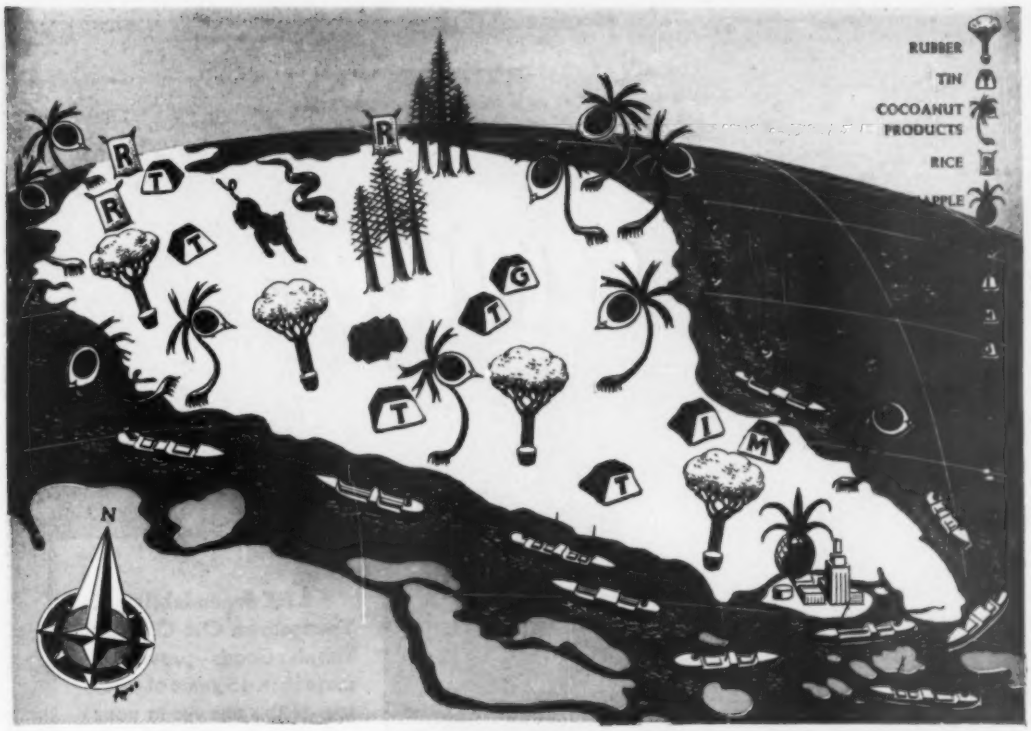

MALAYA

MALAYA . . . The tropical Malay peninsula and adjacent islands, comprising The Colony of Singapore and The Federation of Malaya, is amazingly colorful, enchanting, and productive. Its green jungle-clad mountains, rubber plantations and rich alluvial plains provide a large share of the world's rubber and tin; its natural wealth includes cocoanut products, rice, pineapple, timber, coal, iron ore, manganese and gold; its surrounding blue seas abound with fish. Living in friendly harmony with the hospitable Malays in this equatorial clime are Chinese, Indians, Burmese, Siamese, Indonesians and Occidentals from many countries.

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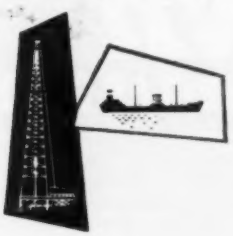

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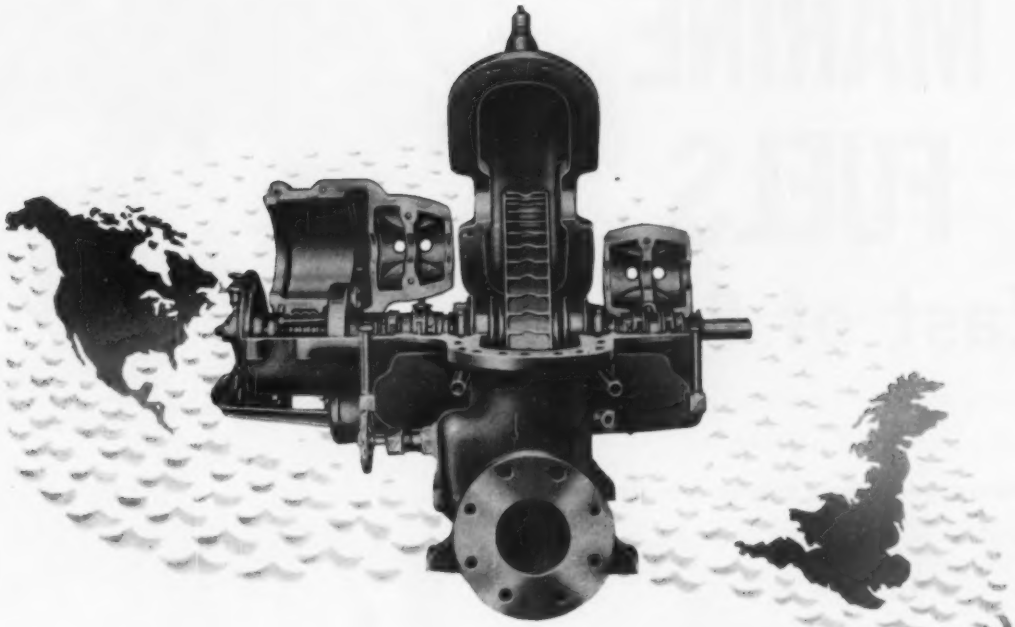

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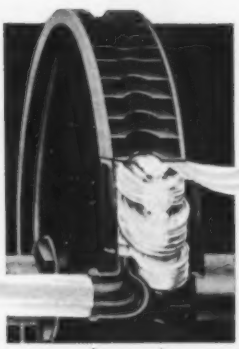
INTRODUCING THE

Turbine



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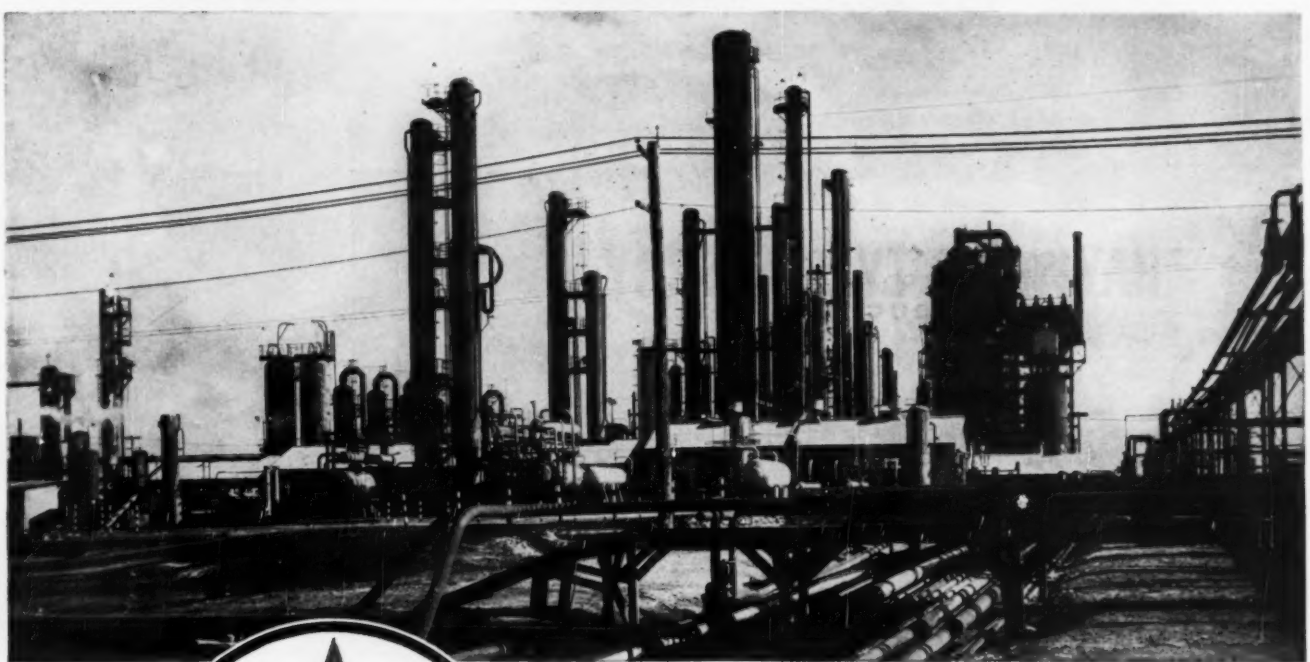

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Founded by Russell Palmer

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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This Month's Cover

At the time this photograph was taken, nearly four miles of drill pipe was racked in the 215-foot Lee C. Moore derrick in the National Supply Ideal rig used to drill Superior Oil Company's Pacific Creek No. 1 wildcat, which recently set a new depth record of 20,521 feet. Photo by Robert Yarnall Richin. Please turn to page 32 for a detailed article and more pictures of the record-breaking rig.

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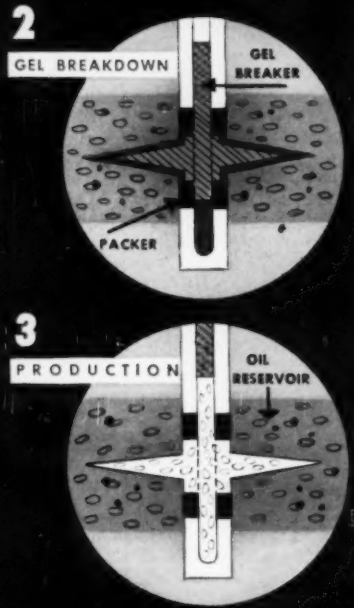

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EDITORIAL

THE CRIME OF BIGNESS

IN a nation industrially organized as is the United States, there is room, and need, for a great variety of enterprises both as to number and size. The general store which serves the scattered residents of a small rural community or the corner market which draws its trade from a radius of a half-dozen city blocks has its function to perform, just as truly as the huge caravansary which boasts that it can supply everything from safety pins to grand pianos or the big corporation with tens of thousands of shareholders and millions of customers extending its operations halfway across the continent. And it is in the American tradition, verified by the nation's history, that many of its industrial giants have grown from exceedingly humble beginnings, a process that still continues.

In this respect the oil industry is typically American. The men who flocked to western Pennsylvania following Drake's discovery, or who overran eastern Texas when Spindletop came in, were not men of wealth. They were men of energy, daring and unquenchable optimism, and out of their efforts came a few nationally known organizations and a far greater number of less conspicuous undertakings which in the aggregate have contributed enormously to the nation's growth in wealth and industrial strength. Viewed in its entirety the oil industry is still, as it always has been, a business composed mainly of small and moderately sized units, independently operated and as strongly competitive as any to be found. While there are a score of so-called "major" companies engaging in all branches of the industry, only two or three of these extend their activities to all parts of the Union, while there are a thousand times as many individually or locally owned and managed which confine themselves to single fields of operation — production, transportation, refining or distribution—and serve efficiently in meeting the needs of their respective areas. In view of the vigorous competition that pervades the industry, charges that it is monopolistic become so grotesque as to be ridiculous.

Development of large "integrated" companies handling the movement of oil from well to roadside distributor has come about in response to national needs and growth. Petroleum is found only in certain sections, many of them distant from centers of dense population and high industrial activity. Petroleum products, however, are in universal demand and must be supplied to the factory, the farmer and the householder wherever located. The presence or absence of the industry's raw material in a particular region is dictated by nature, but the location of the refinery that turns it into finished products is determined by contiguity either to sources of supply or to important markets and by economical transportation connections with both. Viewed in perspective pipelines are merely appurtenances of the refinery, highly important in enabling it to compete. Assurance of a dependable supply of crude and of well distributed marketing outlets are likewise essential to continuing and economical operation of plants equipped for large-scale production and representing the investment of hundreds of millions of dollars.

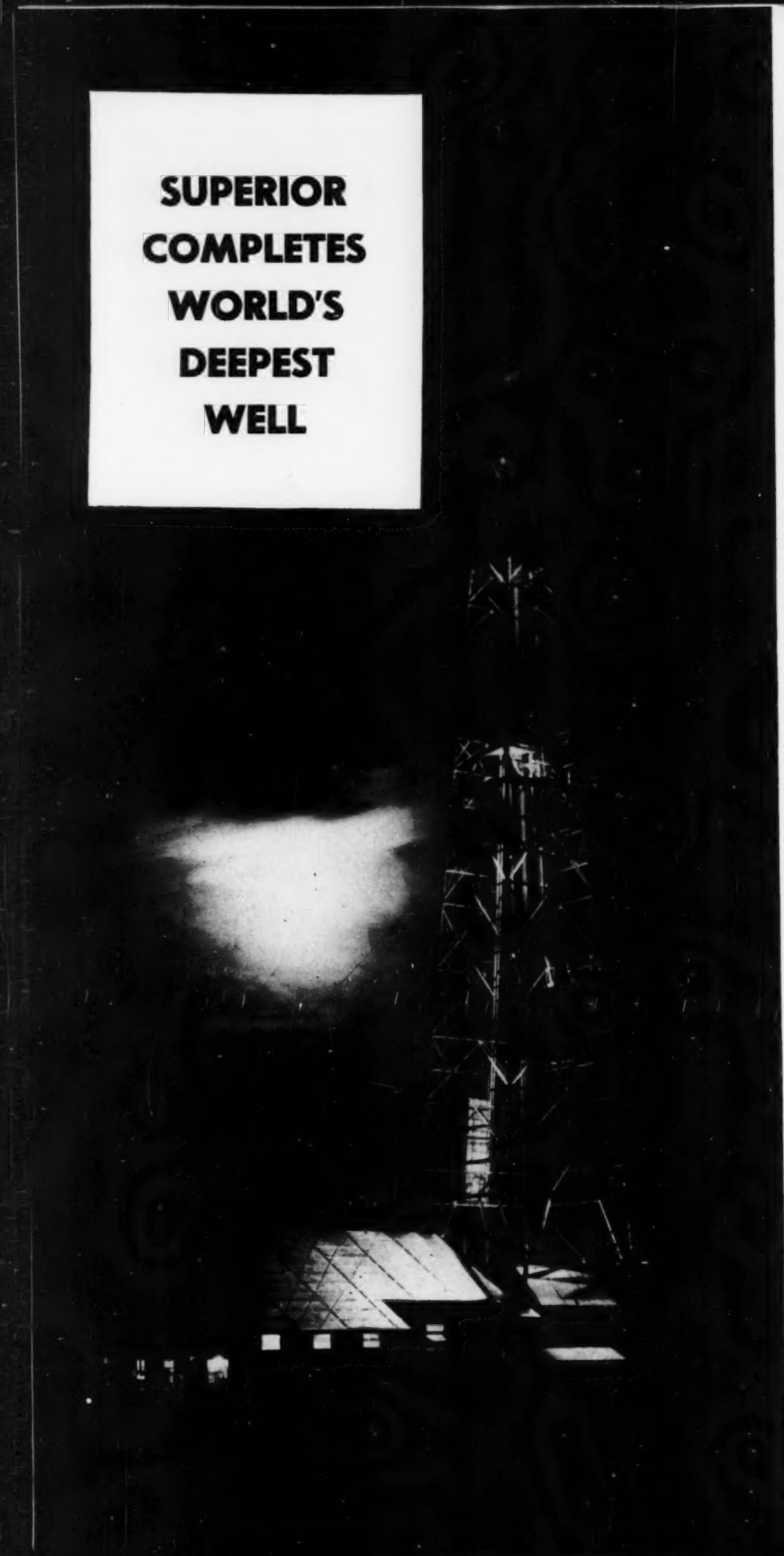
Integration is necessary to the maintenance of such facilities. The nation's industries require the services of large and fully equipped companies; national security is buttressed by them. Without them it would have been impossible to shift the oil resources of the country quickly to meet the requirements of war, as was done in the earlier years of the present decade, or to provide with requisite speed the great increase in capacity called for by the unexpectedly rapid rise in demand in the post-war years.

While Americans inherently are admirers of bigness wherever it denotes efficiency and have demonstrated its value in many ways, such as the assembly lines of mass production plants, there has developed in certain political circles a disposition to treat mere bigness as being in some unexplained fashion a threat to the national welfare and to smaller enterprises. This is a credo to which the present federal administration ardently subscribes, to judge by the number of legal attacks it continues to launch against companies and individuals whose only obvious offense is that of being conspicuously successful.

Such a course is difficult to reconcile with the drive which the administration is conducting to extend federal controls and to substitute government for private business management to a steadily increasing degree. Consistency, however, is hardly a distinguishing characteristic of politicians; attacks upon business and specifically upon the oil industry long have been held, correctly or not, to be successful vote getters.

An instance of this trend of thought is the disinterment of the proposal for dismemberment of the larger oil companies, forcing them to engage in no more than one branch of the business. Thus a refining company could not participate in the ownership of pipelines on which its operations depend. Similarly a producer could not engage in refining, nor could a processor market the products he turns out. Such a proposal for turning back the course of progress could result only in increasing costs and shackling efficiency. It is, however, embodied in bills now before Congress, though apparently not destined for early consideration.

SUPERIOR COMPLETES WORLD'S DEEPEST WELL

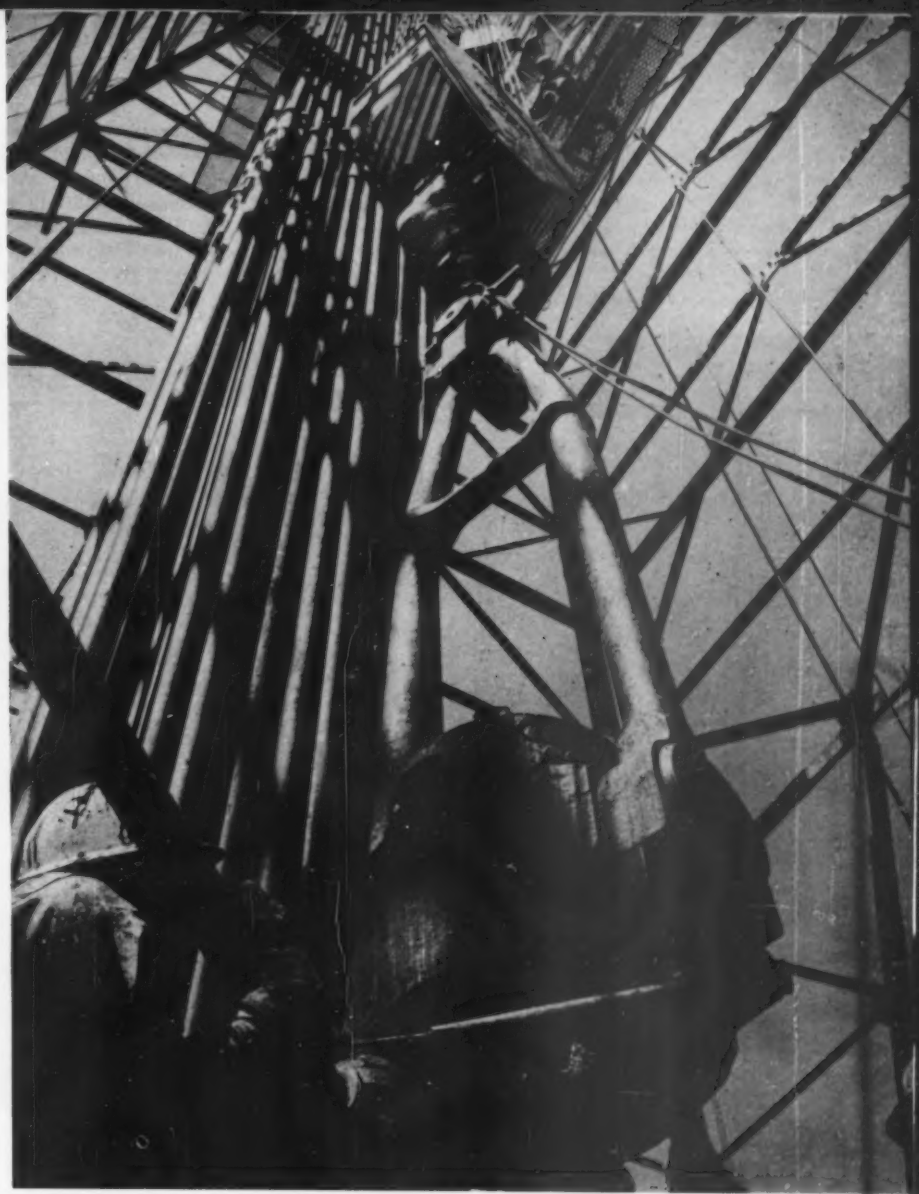


FOR years past oil men, particularly those concerned with oil production, have speculated on the possibility that some day, somewhere, a well would be drilled to a depth of 20,000 feet. Within the experience of many men still active in the industry, a 10,000-foot well was something to excite wonder, and as late as 1932 only a dozen such wells had been sunk in the entire world. Theoretically the attainment of this or even greater depths was feasible, but the practical difficulties became steadily greater as the line of drill pipe grew longer and the cost of the operation multiplied with the depth.

With the continuous growth in the size and power of drilling rigs and the constant improvement in operating methods, the depth record moved to higher and higher figures. It was a noteworthy event when the 15,000-foot mark was passed in 1938, and as the investment rose to a half million dollars for a single dry hole, it began to appear that a financial rather than a physical limit would set the final boundary for such undertakings. Still the adventurous spirit of the probers of the earth's depths was not quenched. Year by year the bit reached farther down and the depth record passed from state to state, from California to Texas, to Oklahoma and back to California again. When the 18,000-foot mark was passed, confidence grew that within the near future the combination of persistent effort and favorable conditions would lead to the record that had seemed but a distant dream only two decades ago.

Early in June the word was flashed that the 20,000-foot level had at length been broached. and on June 17 Superior announced a final depth of 20,521 feet. The record goes to none of the states that has been a holder of such marks in recent years, but to Wyoming, a recognition of the growing importance of the Rocky Mountain area in the general oil picture. The well is Superior Oil Company's Unit No. 1 in the Pacific Creek area of Sublette County near the Sweetwater County line. Its location is officially described as "SW NE SW 27-27N-103W," on the northeast side of the Green River basin.

Oil and gas possibilities in the deep portions of the Green River basin have been of great interest since the discovery of gas by Mountain Fuel Supply Company in the Church Buttes field in the southwestern part of the basin, at 12,500 feet in Dakota sands in 1946. The discovery followed extensive geophysical work in the area by Mountain Fuel, and there have been further geophysical surveys since that time. The Pacific Creek wildcat is located on a line of Tertiary folding south and west of the Wind River Mountains and north of the Baxter Basin anticline. A very thick layer of Tertiary overlays the area, much thicker than expected following seismic work in the area. In addition to the Pacific Creek deep test, several other wildcats are now scheduled in this area of Wyoming to depths below 12,000 feet. The majority of prospects are located on Tertiary structures, confirmed with seismic work. At the present time Stanolind Oil and Gas Company is drilling a deep test on a large surface Tertiary structure in the Canyon Creek area, along the Colorado-Wyoming line on the south



Ideal E-54 connector and 540-ton traveling block used in drilling the Superior well. Hoisting equipment is the largest heretofore used in the petroleum industry. All photographs with this article are by Robert Yarnall Richie for National Supply Co.

side of the Green River basin, and others are planned in the vicinity of Pacific Creek.

Discoveries in the Church Buttes field, at Worland, Washakie County, and at West Poison Spider, Natrona County, where oil is produced from Frontier sands at 14,309 feet, indicate that an era of deep drilling is now under way throughout the numerous basins of the Rocky Mountain region.

Drilling of Pacific Creek No. 1 was begun in July 1948, as soon as the rig was dismantled after being shown at the May International Petroleum Exposition at Tulsa and reerected in Wyoming. Drilling was continued through the bitter weather of last winter by four six-man crews. In one of the worst blizzards the company snowplow once was unable to get through at the normal relief time, and one crew stayed on the job 24 hours.

Actual drilling was begun at a depth of 9,881 feet where a previous operation had been suspended in November 1947. Since the old hole was only nine inches in diameter, it was first reamed to 12¼ inches and then drilled to 9,929 feet where 9⅝-inch casing was set. From this point an 8⅜-inch hole was drilled to 19,765 feet where seven-inch pipe was set. A total of 497 joints of 26-to-29-pound SAE 4340 was run in the well in 23 hours, after which 1,000 sacks of cement were pumped down.

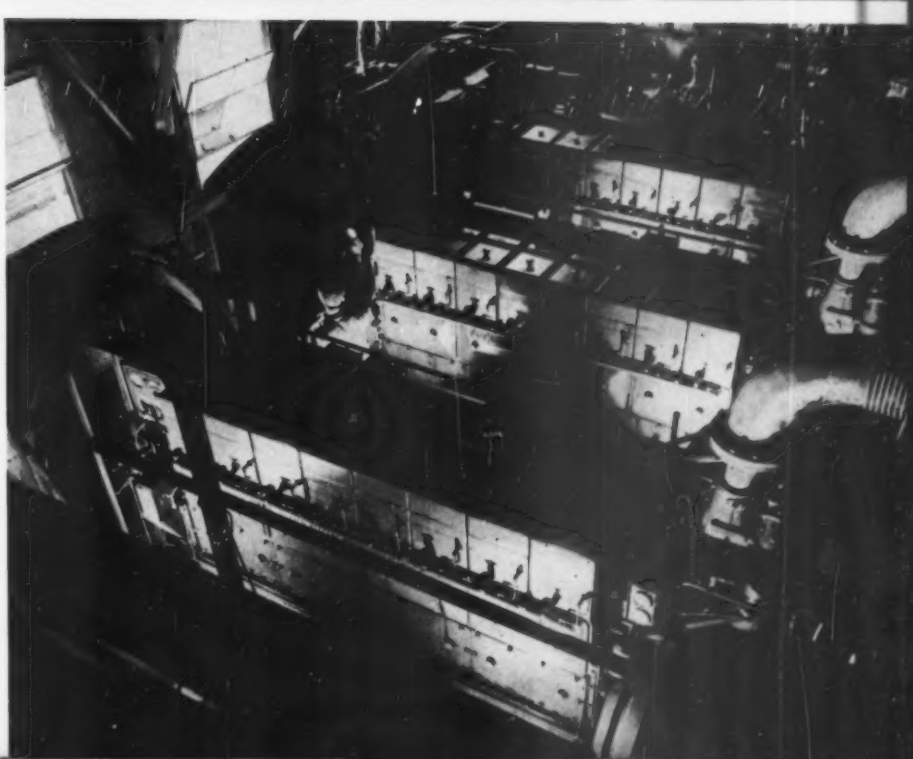
The casing program for the record string of 19,765 feet was as follows:

SAE-4340 7-Inch OD (Feet)	Extreme Line Casing	Pounds
1990	32-lb. top	64,000
2001	29-lb. top	58,000
3280	26-lb. top	85,000
4288	29-lb. top	124,000
8206	32-lb. bottom	263,000
		594,000

Plastic coated drill pipe was employed to minimize corrosion. The tapered string consisted of 4½-inch pipe to 17,700 feet; 3½-inch pipe to 19,765 feet, and 2⅜-inch pipe below the casing point. A bumper-sub safety joint was carried above the drill collar.

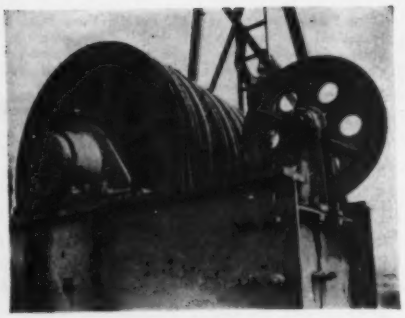
The drilling operation was largely uneventful. The accuracy of the automatic feed-off was such that bit consumption was low. Only 177 bits were used between 9,929 feet and 19,765 feet. At depths around 20,000 feet the operation proceeded at an average drilling rate of 50 feet per day.

It is appropriate that the drilling of the world's deepest well was done by the world's largest diesel powered rig designed especially for deep

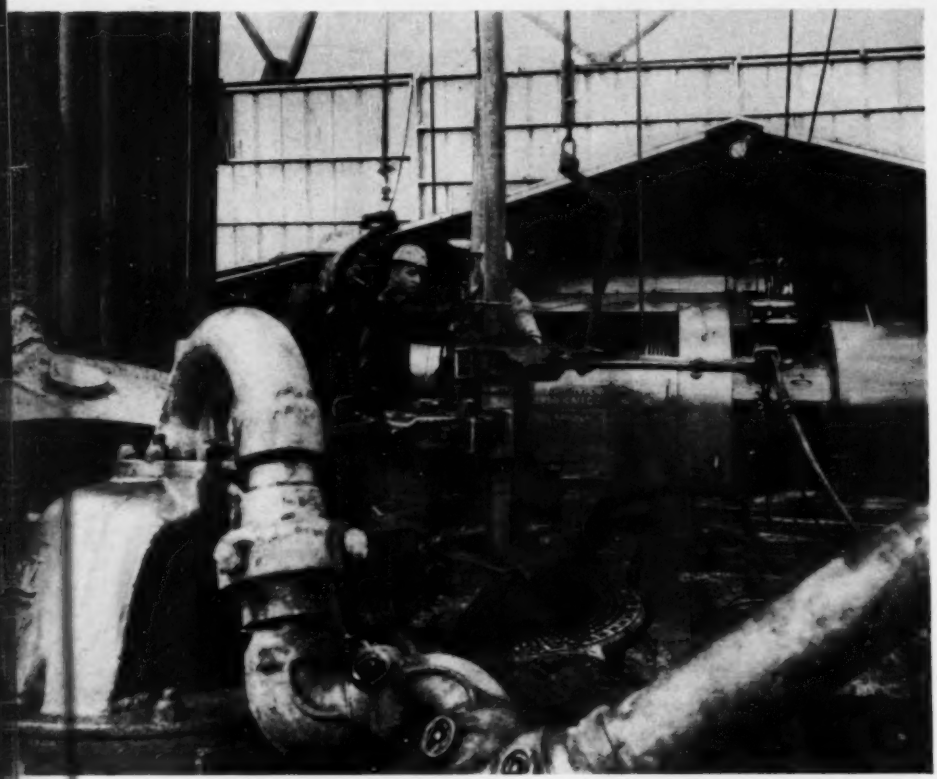


Three Superior supercharged diesel engine with a combined output of 2,010 hp. supplied power to the rig and pumps. Two similar additional engines were available for an additional Type E-700 power slush pump.

penetration. The outfit, which attracted much attention when first displayed at the Tulsa oil show last year by the National Supply Company, includes an Ideal consolidated rig powered by three Superior dual-fuel diesel drilling engines with 2010 combined horsepower. Two pumps, rated one at 825 and one at 495 input horsepower, are driven from the three-engine drive group. An additional E-700 pump is independently driven by two engines identical with those on the drawworks. The rig has a combined horsepower of 3350, almost the equivalent of two main-line diesel locomotives. Hoisting equipment, including a seven-sheave, 630-ton crown and a six-sheave, 540 ton traveling block used with a 1½-inch wire line, represents the largest of its kind ever built.



Unusual photograph of the 630-ton crown block snapped by Photographer Richie at the top of the 215-foot derrick. Wire line 1½ inches in diameter was used.

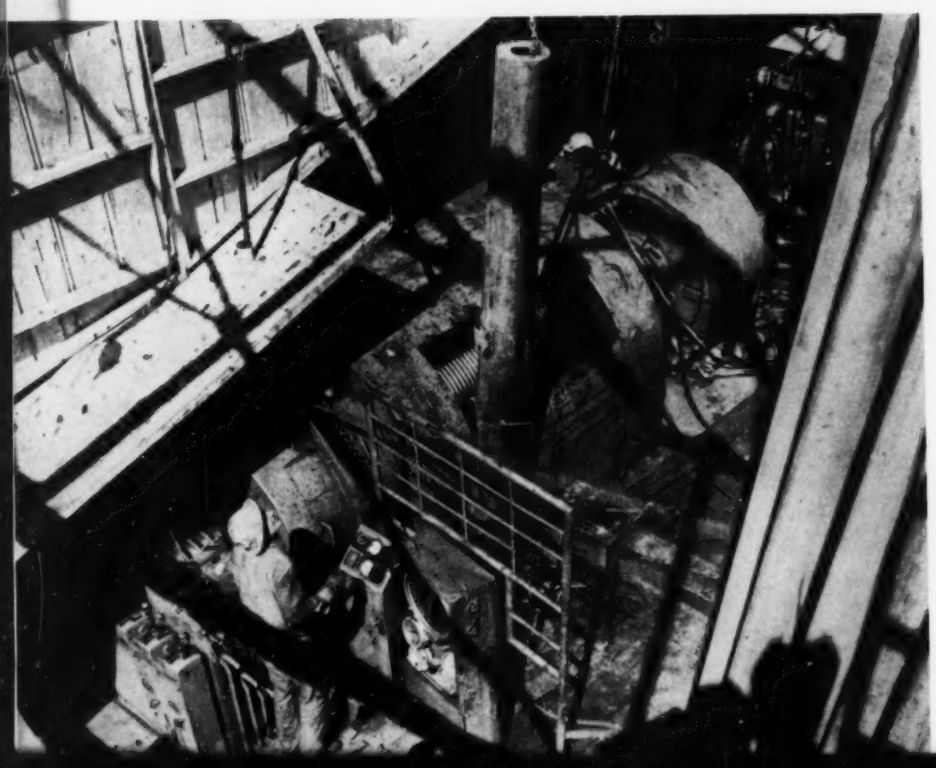


Making up a drill pipe joint. After casing was set at 19,765 feet drilling was continued with a tapered string of about 14,000 feet of 4½-inch on top of 3½-inch drill pipe to bottom.

One of the features of the drawworks which has proved very successful is the new Ideal micromatic drilling control. The driller merely turns a valve handle to maintain the desired weight on the bit, the rate of penetration in feet per hour being indicated on a feedometer. The drum is driven through a reduction gear by a hydraulic motor. This motor is powered by an oil pump driven from the rotary countershaft. Thus when the rotary machine is stopped for any reason, the control automatically discontinues feeding the drill string. This "feed off" has shown itself so dependable that drillers can leave the drillers' position for short intervals to supervise other work around the rig. There also has been a saving in the number of bits used, since the operator has a precision control for feeding at the optimum rate.

A shaft drive from the drawworks to the rotary machine eliminates the former chain drive, which has been an obstruction to efficient working of the drilling crew. The rotary is driven through a separate transmission, which permits a relatively slow speed for unscrewing the pipe when coming out of the hole in one of the higher hoisting speeds.

A unique method of dynamic brake hookup is utilized on this large rig. A master electric switch is hydraulically operated from a pressure diaphragm installed on the dead line. When the weight suspended in the derrick exceeds 65,000 pounds, the switch is "on," allowing the brake to be energized in the normal manner by the drawworks brake handle. When the weight is less, the master switch is "off," and the dynamatic brake cannot be operated regardless of the fact that the brake lever may be applied.



Driller's position of the National Type 160 rig with Martin-Decker combination weight indicator and wire line anchor at right. Controls have been engineered to provide positive control of all rig operations from the driller's position.

One of the greatest improvements to be incorporated in a modern power rig is the drive from engines to drawworks and pumps through hydraulic couplings. These couplings, called Ideal gyrol fluid drives, are mounted adjacent to each engine on the engine extension shafts. An adjustable sliding scoop can vary the amount of fluid in the coupling and can completely empty it, thus eliminating the necessity for an engine disengaging clutch. The scoop, which is air operated by the driller, regulates the amount of fluid in the coupling and, therefore, the degree of slip. By varying the engine speed and the slip of the coupling, a very wide range of speed and power is available for the pumps, drawworks and rotary.

An example of one of the advantages offered by the gyrol fluid drive was realized during reaming from the surface pipe to a depth of 9,881 feet. The rig was set up over an old nine-inch hole and reamed to 11 inches. The rotary table was operated with a high transmission speed ratio, the speed being reduced by slipping the No. 1 engine coupling, thus limiting the power transmitted to the table. When torque built up in the string due to excessive cuttings or cave-ins, the coupling slipped completely, stalling the table and eliminating the danger of a twistoff. This condition was actually encountered several times.

The rig is equipped with large atmospheric air chambers enabling compounding of the power pumps. As a result of past experimentation it has been found that the fluid drive is a valuable adjunct, if not a necessity, to successful pump compounding. Compounding was carried on for a short period between 11,000 and 12,000 feet to test the installation.

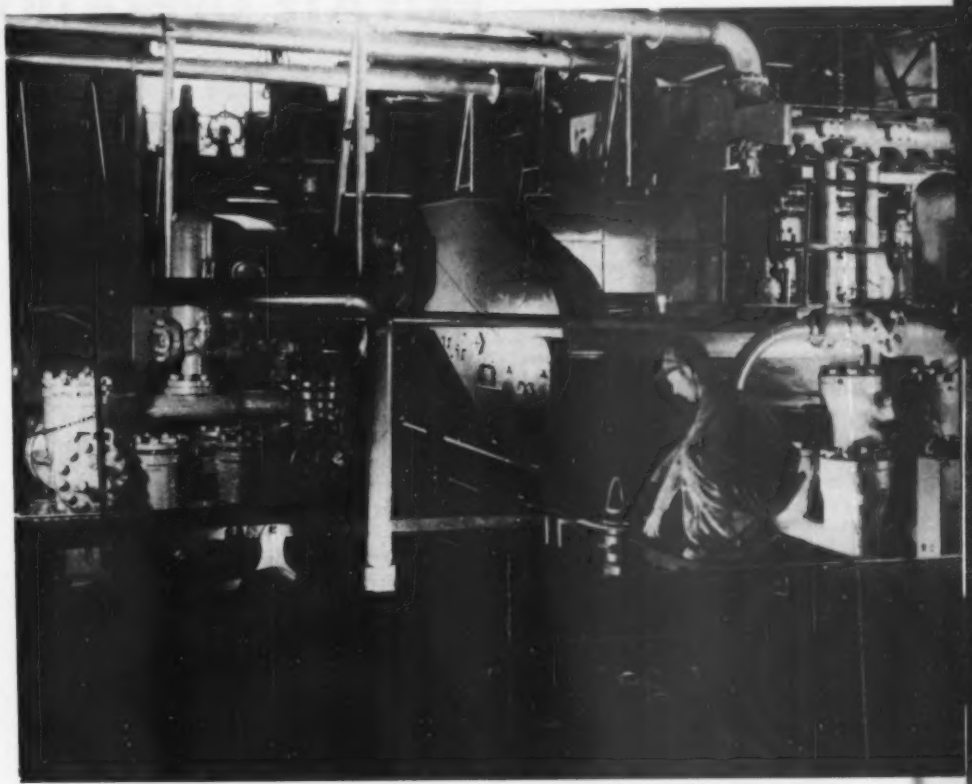
Operation of the rig at this location has provided evidence of the feasibility of using 1½-inch wire line. Performance records show that this size line has no more whip and spools as well as the normally used lines. This line also gives service life comparable to 1⅛ and 1¼-inch lines on smaller rigs.

The Lee C. Moore derrick incorporated in the rig has an overall height of 215 feet from concrete footings to top of ginpole. Base of the derrick measures 37 feet, 9⅝ inches, and top, nine feet. The derrick is of the "K" type with an API capacity of 1,100,000 pounds. The independent substructure is of the pedestal type with a total height to the derrick flood of 13 feet, three inches.

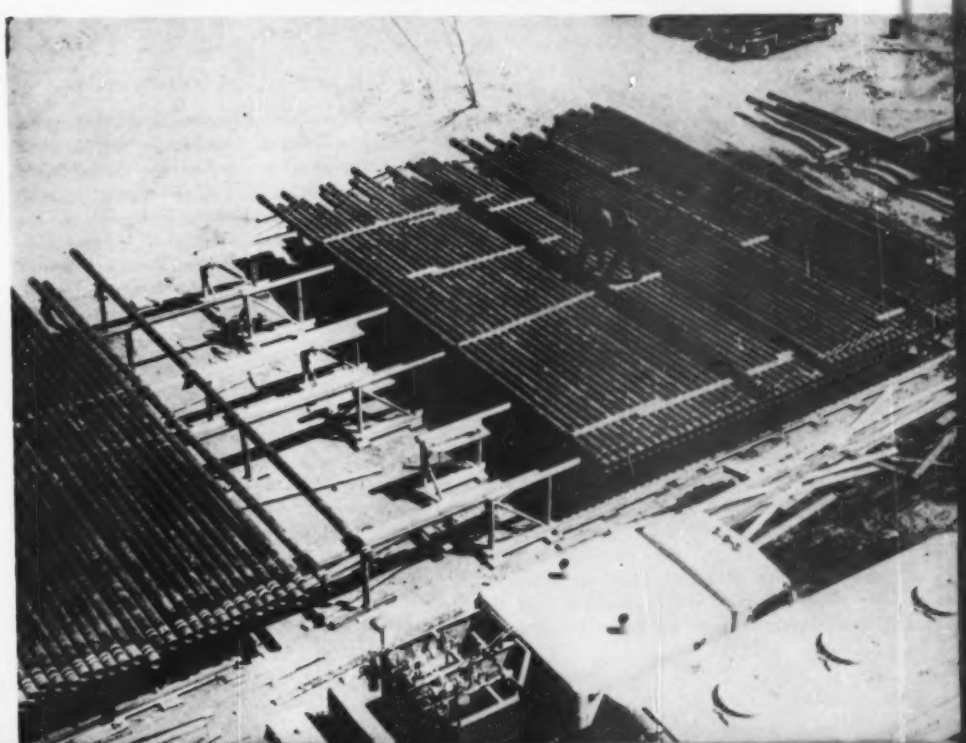
Overall width of the engine foundations is 48 feet, and the main skids are 39 feet long. The power substructure is 5½ feet high, and the drawworks bench six feet high.

Because of the severity of weather anticipated during the period in which the well was being drilled, the engine, mud pumps and heating boiler were all enclosed in a gable-type steel building measuring 57 by 123 feet, with a height of 20 feet at the eaves.

Superior has been among the oil companies most active in deep exploration. Within the past two years the company has set three successive depth records. In 1947 its Weller 51-11 in Caddo County, Oklahoma, was bottomed at 17,823 feet. In March of this year it abandoned Limoneira No. 1 in Ventura County, California, at 18,734 feet, while almost at the same time Pacific Creek No. 1 surpassed this figure and went on probing new and untried deeps.



Pumps and pump drives. Rig incorporated two Type E-700 duplex power pumps, largest in use in the industry, and one C-350 pump. At greater drilling depths the C-350 and one of the E-700 pumps usually were both mixing and conditioning mud. Much of the time all three were in operation, one drilling and the other two mixing and agitating the mud.



19,765 feet of Spang-Chalfant extreme line casing of SAE 4340 steel was racked at the wall. →

JAPAN'S OIL INDUSTRY UNDER PRIVATE OPERATION

JAPAN'S oil industry was reduced to meagre dimensions by the war and has continued its decline since. In 1945 the production of crude was 1,500,000 barrels or about half the output in 1915. By 1946 it had decreased to 1,321,000 barrels; in 1947 to 1,258,000 and in 1948 to 1,132,000. There has been practically no exploratory work since the war. Lack of up-to-date drilling equipment and labor difficulties stand in the way of field development, and there seems at present little prospect of any change in the dwindling trend of crude production.

In the prewar period, several years before Pearl Harbor, the domestic industry was put under the management of the Imperial Fuel Corporation. This was an official organization formed for the announced purpose of exploring and drilling for oil and of synthesizing liquid fuel from coal. It was supplied with ample funds by the government, had the strong backing of the military party and was put in control of 95 percent of all oil leases in the islands.

Wartime performance of Imperial Fuel was seriously disappointing to its supporters. Synthetic plants, though established under the supervision of German technicians, never remotely approached the success that they attained in Germany itself and contributed practically nothing to the country's military strength. This line of endeavor has been virtually abandoned. The company likewise fell far short of fulfilling its promise to equal or exceed the crude production of World War I. The government was forced to rely on importations from oil-producing areas which it seized at the beginning of hostilities. When these were shut off, it was no longer able to provide adequate fuel for planes and ships.

Approximately two-thirds of Japan's refining capacity was destroyed in air raids between 1942 and 1945. Out of an annual capacity of 18,870,000 barrels, 12,580,000 was lost in that way.

Since the surrender reconstruction has been slow and makeshift and has added less than a million and a half barrels to bring present capacity up to roundly 7,500,000 barrels. Under SCAP orders refineries at Pacific Coast ports were shut down in September 1946, and the only plants continuing in operation were those located in or near the fields along the Japan Sea. These are all small and all privately owned. Nippon Petroleum Company operates refineries at Akita, Niigata and Kashiwazaki. Showa Petroleum Company has plants at Niigata and Hirasawa, and the Japan Mining Company has one at Funakawa.

Present civilian consumption is about 50 percent of prewar levels; 10,693,000 barrels in 1948 against 21,894,000 in 1934. Imports of refined products amounted to 10,640,000 barrels of the total 1948 consumption.

Under the military regime the use of oil has been greatly restricted, being confined at first mainly to the armed forces and then gradually extended to meet urgent industrial needs. Until a few months ago all imports were purchased by a military board and distributed under its supervision. Since April last private operation has been permitted. To preserve stability in the market, the military authorities still maintain a guiding hand and have set up quotas for the various marketing organizations. These quotas are based on estimated requirements and are divided among previous suppliers roundly in proportion to past operations. Three large companies have received about three-quarters of the total allocations. These are Shell, Standard and Caltex, the latter operating through Nippon Petroleum. The following table gives a list of companies, their monthly quotas and their percentage of the total:

Company	Barrels	Percent of Total
Nippon Petroleum-Caltex	253,594	27.7
Shell	223,685	24.5
Standard-Vacuum	223,685	24.5
Nippon Mining	17,165	1.8
Showa Petroleum	43,967	4.8
Mitsubishi	40,000	4.4
General Oil	40,000	4.4
Hinode	40,000	4.4
Japan Fishing Net Co.	23,738	2.6
Others	8,190	0.9
Total	914,024	100.0

Nippon Petroleum Company is the first native concern to realize the hope of many war-shattered companies of attracting American capital to aid in their rehabilitation. Under agreement with Caltex the Japanese organization becomes the distributor of Caltex refined products in Japan. Caltex has taken over Nippon Petroleum's refinery at Tsurumi near Yokohama, paying with crude oil. Caltex will in future import crude and refine it in the plant after its restoration. Profits from refining will be split between Caltex and the Japanese company. The agreement will remain in operation for ten years and may be extended subject to the approval of both parties.

Nippon Petroleum, at the peak of its power, owned nine refineries with an aggregate capacity of about 30,000 barrels daily. The Tsurumi installation was one of its three largest, with a treating capacity of 6,300 barrels daily.

It is rumored in Tokyo that Maruzen Petroleum Company, one of the major storage concerns, is negotiating a deal with Caltex to obtain crude oil in return for the use of some storage facilities. It is reported also that Tao Nenryo (East Asiatic Fuel) Company is negotiating an agreement to convey 51 percent of its stock to Standard-Vacuum in exchange for supplies of oil and managerial assistance.

Before the war the only Japanese firm to have a joint financial arrangement with an American company was Mitsubishi. Tide Water Associated Oil Company held a half interest in its refinery, and it is understood that the agreement between the two companies is continuing.

Removal of all restrictions on imports undoubtedly would result in a rapid increase in oil consumption in Japan. A record number of new motor registrations since the war, mostly heavy commercial vehicles, and the introduction of mechanized farming methods have given demand much buoyancy. Temporarily the shortage of coal has resulted in substitution of fuel oil in many industries. Since both must be imported, oil offers an economic advantage because of its lower shipping and handling cost.

While domestic oil production remains in suspended animation, considerable strides have been made since the war in the development of natural gas. The Otaki Natural Gas Company is increasing its wells by nine to a total of eighty-two. Monthly sales are approaching 400,000 cubic meters. Nearly half of this is compressed for sale in high-pressure containers. Compressed gas has become popular as automobile and industrial fuel. Otaki also established Japan's first "gas" station and is building more in the Tokyo metropolitan area.

In the Niigata oil field intensive development of a gas-bearing stratum has brought encouraging results. The upper stratum, about 200 feet deep, has been tapped for poor returns since about 1930. Recently bores have been sunk to 1,300 feet, and the gas volume available from this stratum is estimated to be equivalent to the heating value of 60,000,000 tons of coal.

The Niigata Natural Gas Development Company was established recently to exploit this valuable fuel source. Four of five bores have been brought in for an average yield of 2,500 cubic meters a day. Preparations are in progress for construction of a 250-mile, 10-inch gas pipeline from Niigata to Tokyo. This is the first project of the kind to be attempted in Japan.

DOMESTIC FUEL OIL SUPPLIES

NOT ABOVE SEASONAL REQUIREMENTS

IN A facetious mood one hot day in mid-July the oil editor of the *New York Journal of Commerce* wrote a brief paragraph to fill out a column. A usually unreliable source in Brooklyn was quoted as reporting that the Standard Oil Company was offering a television set with every summer fill of furnace oil. The paragraph brought into sharp focus the problem which is, indeed, worrying oil refiners again—what to do with summer fuel oil production.

Manufacturers of any commodity with a highly seasonal use factor, such as household distillate fuel oils, always have inventory difficulties. But this year the problem is more acute than normal because both consumers and distributors are postponing purchases. Refinery and primary terminal storage is uncomfortably full, but distributors' and consumers' tanks are low.

Recently the editors of *Fueloil and Oil Heat* asked a considerable number of their distributor readers whether they plan to fill up their storage in the near future. In more than seven out of ten cases the distributors replied that they expect fall prices to be lower, so they are trying to get rid of all present stocks and do not plan to buy until later.

Refiners began their campaign to stimulate business early in the season when it became apparent that distributors were pursuing an abnormal buying policy. First offer was to protect distributors against possible price cuts up to Aug. 31. When this didn't bring in any orders, major refiners agreed to extend price protection to their distributors and consumers up to Sept. 30. That didn't get the job done either. As this is written, a third step has been taken. In addition to price protection the oil companies are offering special summer discounts. For July deliveries a discount of 0.6 cent per gallon was offered and for August deliveries the discount was 0.5 cent per gallon. Discounts were made on deliveries of kerosene totaling 150 gallons or more as well as on No. 2 oil.

It remains to be seen whether the lack of confidence in price stability will be effectively overcome by the combined offer of discounts plus price protection up to Oct. 1. Socony-Vacuum Oil Co. injected the scarcity angle as another reason for early buying in its publicity release announcing summer discounts, and Standard Oil Co. (Ind.) reread Aesop's Fables and sent its customers a rewrite of the sad story of the grasshopper who fiddled the summer away while the ants were busy preparing for winter:

Now once a long, long time ago,
oh many years ago,
A group of busy little ants
were storing stuff below
They worked and worried (if ants can)
and slaved the whole day long,
While nearby sat a grasshopper
just fiddling a song.
He fiddled tunes with nonchalance—
oh he had lots of fun,
And never did a lick of work
from dawn to setting sun.
But pretty soon September came,
the nights grew cold and chill,
So underground the wise ants went
into their warm ant hill.
Old 'Hopper stopped his fiddlin' fast,
and wondered what to do . . .
No food to keep himself alive,
no fuel to see him through.
He pleaded with the ants for some,
but they were unconcerned,
They asked him just this one question,
"What lesson have you learned?"
He hesitated to reply
and shivered so with cold,
Then slowly said, "Before I go,
this moral should be told:
Be sure to call your Fuel Oil Man,
and fill your tanks today . . .
Then you'll be cozy, warm and dry,
when summer slips away!"

There is real reason for concern about the ability to supply next winter's demand for middle distillates in the event of normal weather, and it is, of course, possible that last winter's mild season may be followed by one of subnormal temperatures. Concern over ability to supply the market adequately is based on the large increase in number of burners, increase in demand for diesel fuel plus the likelihood of colder weather.

In the first five months of the year oil burner installations in the United States totaled 141,689. This compares with 123,415 in the same period in 1948 when the oil scarcity was retarding sales. The figure for total installations quoted above is somewhat misleading, however, because in the early months of 1948 when oil was scarce, burner manufacturers and distributors were centering their attention on the sale of replacements. In the first five months of 1948 burner men sold 39,216 replacements, making the net increase in burners in homes 84,199. This year replacement sales in the first five months totaled 26,577, making the net increase in burners 115,112. The increase in net burner sales was thus 30,913 or 37 percent. Moreover the figures seem to be snowballing somewhat. In May total sales were 44,621 or nearly 30 percent of the five-month record. There were 3,978,860 domestic oil burners in use in the United States on Dec. 31, 1948, according

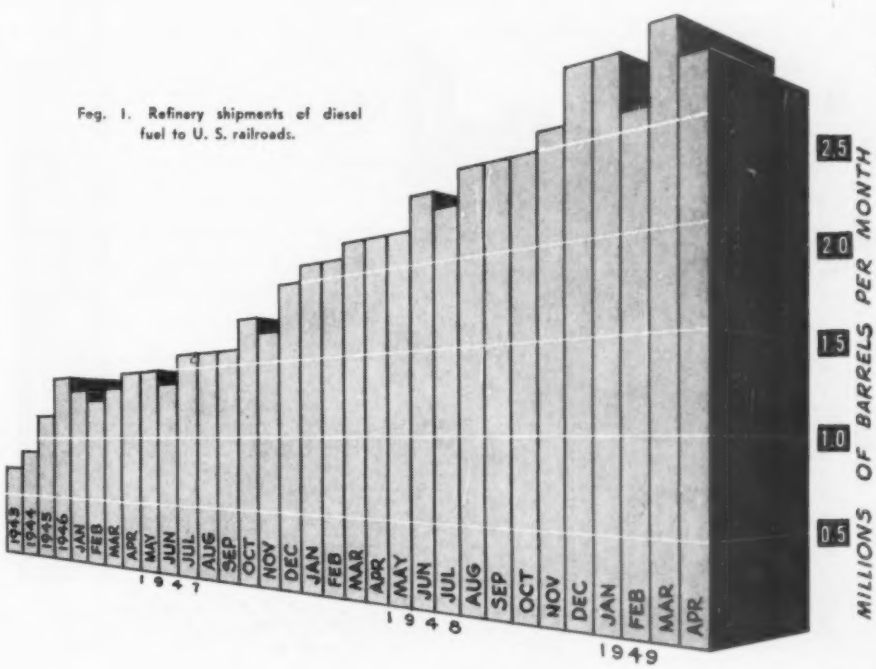


Fig. 1. Refinery shipments of diesel fuel to U. S. railroads.

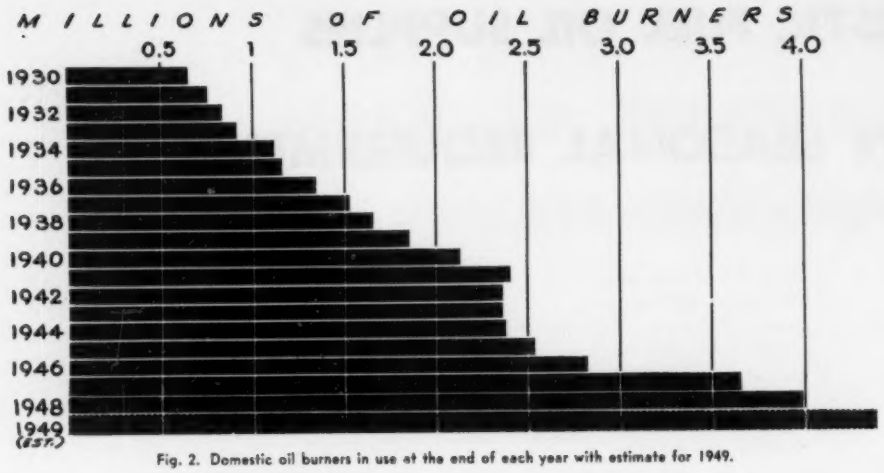


Fig. 2. Domestic oil burners in use at the end of each year with estimate for 1949.

to calculations of *Fueloil and Oil Heat*. This may be assumed to be the average for the heating season. Based on net installations in the first five months, it seems likely that the average number for the coming heating season will approximate 4,400,000, an increase of 11 percent over last year. The trend in oil burner installations is shown in Fig. 2.

A factor of growing importance in the middle distillate market is the rapid rate of increase in demand for diesel fuel. Dieselization of the railroads is proceeding at a very rapid pace, as is indicated in Fig. 1, showing the consumption of diesel fuel by Class 1 carriers. In 1943 the railroads consumed only nine million barrels of diesel fuel. By 1946 this had been doubled, and in 1948 the total was about 29 million barrels. In the first four months of this year U. S. Bureau of Mines figures reflect an increase of 2.7 million barrels or 30 percent over the first third of 1948.

Use of diesel fuel by trucks, buses and stationary power plants is increasing, but not quite as rapidly as on the railroads. In the first four months total deliveries of diesel type fuel by oil refiners increased 5.8 million barrels or about 25 percent over last year.

In comparing distillate fuel demand from year to year, the weather must be taken into consideration because of its profound effect on volume. Last winter, for example, the temperatures on the East Coast were 17.5 percent warmer than the previous year in the months of October through March. Oil consumption does not decrease ratably with temperature, but there was a loss in sales due to the weather alone of 131,000 barrels per day in the United States.

An indication of the possible increase in demand for distillate fuels in the coming season may be had if the factors enumerated above are added together. Diesel fuel demand likely will be nine million barrels greater than last winter in the October-March period. The increased number of oil burners will add a load of 20 million barrels. Return to normal temperatures would add 23 million barrels to the load of previously installed units. Assuming normal weather, it is suggested that the increase in demand will be on the order of 52 million barrels. In the six months ended March 31, 1949, shipments of distillate fuels totaled 206,487,000 barrels. The increase would thus be on the order of 25 percent. For furnace oil demand alone Socony-Vacuum recently estimated a possible increase in demand of 20 percent.

Since the shortage scare of 1947-48, the industry has increased its storage capacity substantially. At the opening of the season last year refinery and primary terminal stocks of gas oil and distillate fuel oil totaled 83 million barrels. This was the highest inventory in the history of the industry and was achieved only with extraordinary effort. It should be recognized, of course, that 83 million barrels of fuel was not available for use by consumers. In the previous winter stocks never dropped below 34 million barrels despite the shortage. It may be assumed that 34 million barrels approximates minimum working stock and that the refining industry has an available storage capacity of about 50 million barrels.

Fig. 3 gives an analysis of diesel oil and distillate fuel shipments by months since January 1948 and illustrates the highly seasonal character of the heating oil demand and the relatively level diesel oil demand. Eliminating diesel fuel it is seen that heating oil shipments are nearly four times as great in January as in July.

Refiners regulate their yield of middle distillates somewhat between winter and summer, but the variation is not commensurate with the change in seasonal demand. Maximum yield in the history of the industry was 20.6 percent in February 1948, and the low in that year was 17.7 percent of crude runs. Average for the year was 18.6 percent. Yield trends in recent years are shown in Fig. 4.

With a stock available for shipment at the opening of the season of about 50 million barrels, a prospective increase in demand of 52 million barrels, a relatively inflexible yield from crude oil and a 4:1 seasonal demand factor, it is clear that there is still a possibility of trouble during the coming season.

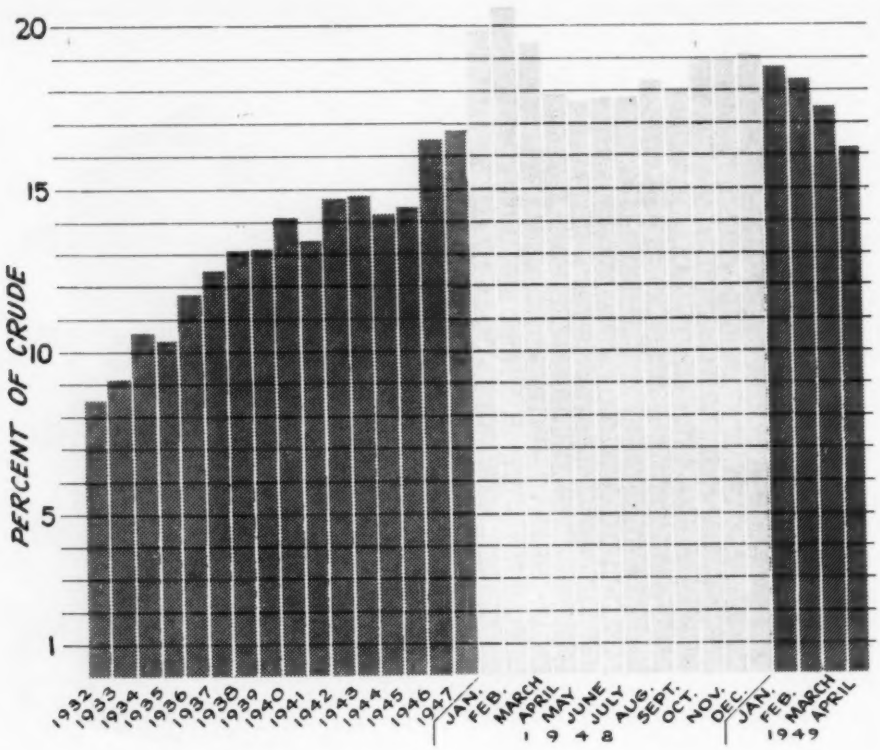


Fig. 4. Yields from crude of gas oil and distillate fuels have been reduced sharply in recent months.

Fuel oil distributors could minimize the difficulty by buying in midsummer, as they have a storage capacity of about 22 million barrels. A theoretical maximum of 34 million barrels of stored oil could be added if all consumers would enter the heating season with tanks full. Total cushion at the beginning of the season could be up to about 106 million barrels or nearly 50 percent of the season's demand. If refiners are unable to get distributor and consumer tanks relatively full, about all they can do is to keep their fingers crossed and be nice to the weather man.

Characteristics of kerosene and No. 1 fuel oil situation are quite similar to gas oil and distillate fuel. Installations of space heaters which burn this lighter fuel are going forward at an accelerated rate. Last winter consumption was off about 6.5 percent from the previous year, but a cold winter plus this year's increase in sale of burners could easily create difficulties. Current storage at refineries and terminals is about 24 million barrels, of which not over half is available for immediate shipment as an excess over working stock. Peak winter demand is at least 30 percent above production capacity, and, in the case of kerosene, the possible yield from crude is far less flexible than in the case of distillate fuels. Maximum yield is somewhat less than seven percent of crude, and there is not much that can be done about this particular fraction.

While prospective demand for middle distillates is heavy, refiners are less fortunate in the case of residual fuels. The increase in diesel oil demand by railroads is cutting deeply into the use of heavy fuels by this class of customer, and the economic situation likewise has made itself felt in lowered sales. Refiners are using price to correct this situation with considerable effect, however. In a recent address before the National Association of Purchasing Agents at Chicago, Rexford S. Blazer, president of Allied Oil Co., Inc., Cleveland, reported that reductions in heavy fuel prices have brought about changes over from coal to oil on the Atlantic seaboard totaling 40 million barrels per year.

Early in the autumn last year the price of heavy fuel in New York harbor was $3.00 per barrel according to *Platt's Oilgram*. The current price is only $1.60 per barrel. In the midcontinent the peak price for fuel oil was $2.50 per barrel in 1948, and this is now down to 60 cents per barrel. These very drastic price cuts permitted refiners to move 173 million barrels of residual fuel in the first four months of the year compared with 185 million barrels in the corresponding months of the year before at the time when all fuels were in very active demand. This reduction of only 6.5 percent in shipments was a far better record than was being made by the coal industry, where stocks increased 50 percent in 1948 and have been reduced only slightly this year in spite of labor holidays and the current three-day week.

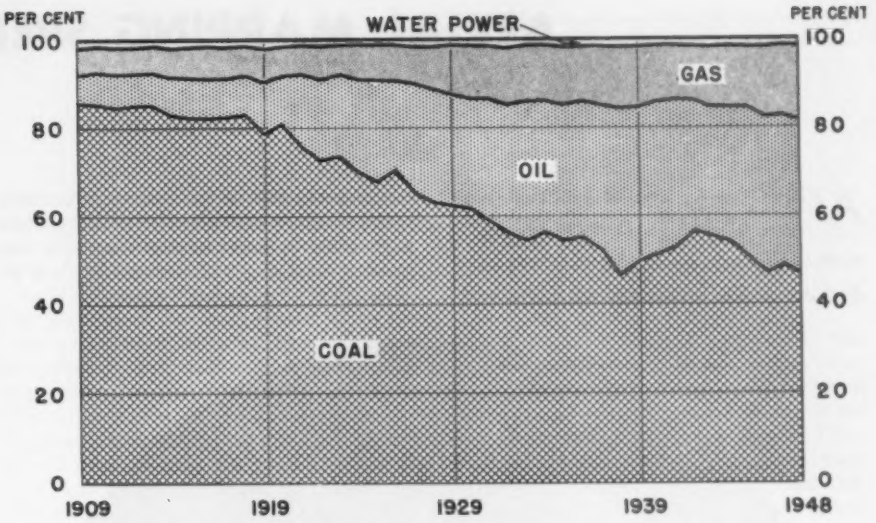


Fig. 5. Chart prepared by Dr. Richard J. Gonzalez of Humble Oil & Refining Co. showing growth of oil and gas and decline in coal as sources of energy in the United States.

Even at the higher prices for residual fuels which prevailed in 1948, oil continued to gain ground against coal as a source of energy in the United States. Charts prepared by Dr. Richard J. Gonzalez of Humble Oil & Refining Co. for a recent symposium on Gulf Coast hydrocarbon resources and reproduced here as Figures 5 and 6 indicate that 1948 oil prices were 125 percent of the 1926 level, whereas coal prices were up to 180 percent of 1926. The spread has been growing wider this year as fuel oil prices have tended lower while coal prices have been less responsive to changes in demand.

Over the long run coal may return to its former dominant place as a source of energy, but today it is supplying only about 47 percent of the country's energy, compared with 85 percent in the early years of the century, and aside from the seasonal factors there is no immediate shortage of liquid hydrocarbons in sight to force a return to the less convenient form of heat offered by coal.

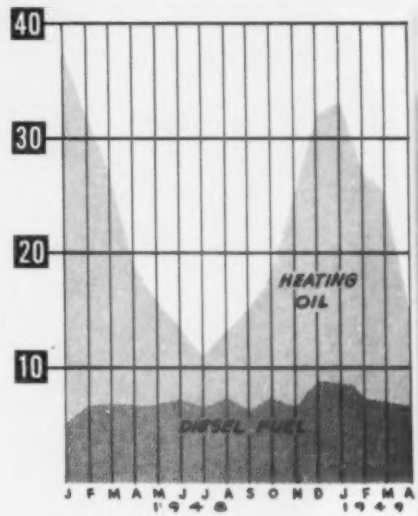


Fig. 3. Analysis of distillate shipments indicating highly seasonal character of heating oil demand as compared with diesel fuel demand.

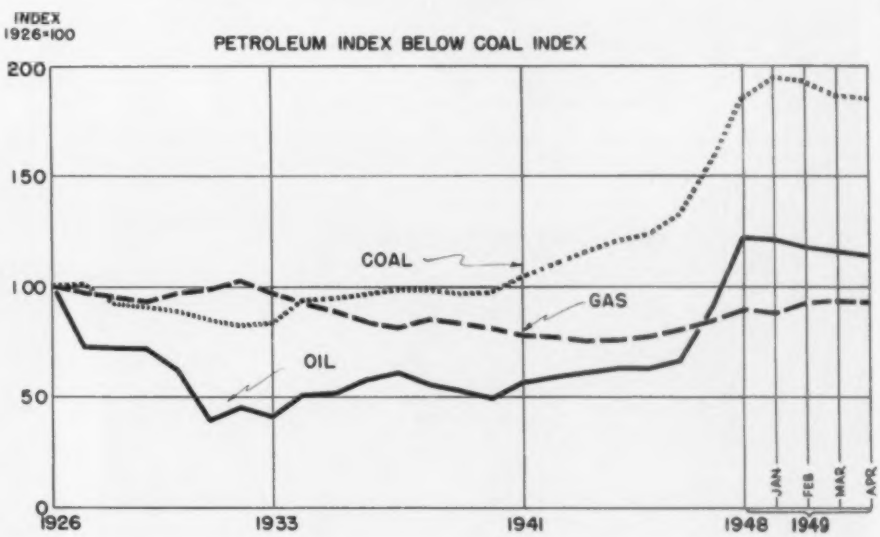
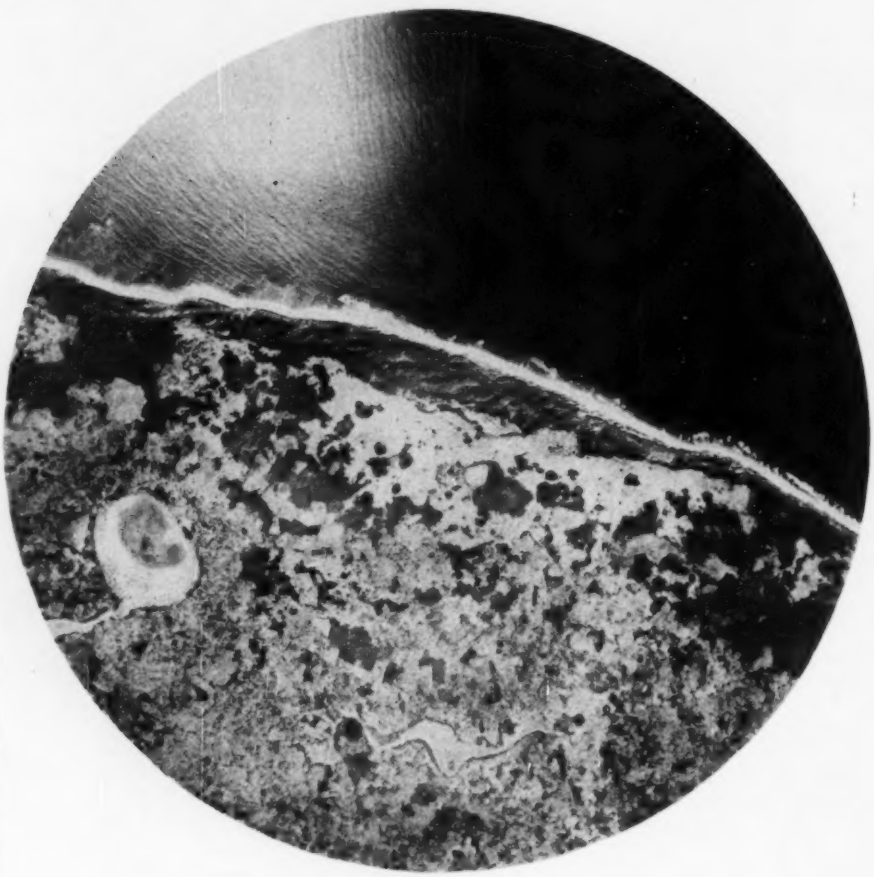


Fig. 6. The price relationship of coal, oil and gas since 1926, a prime reason for the loss of markets by coal. Chart reproduced through courtesy of Dr. Richard J. Gonzalez of Humble.

AERIAL MAPPING SPEEDS MOZAMBIQUE

AERIAL mapping is speeding the exploration of the Mozambique Gulf Oil Company's 47,000-square mile concession area in Portuguese East Africa. The aerial reconnaissance is being performed by Aero Service Corporation of Philadelphia, with precise mapping cameras and the high sensitivity airborne magnetometer, a geophysical exploration tool developed by the Gulf Research & Development Company.



View of Mozambique coastal formations from the air.

The aerial survey began last July. Flying is now completed. Soon after the survey's start the map compilation began, and the first preliminary aerial magnetic maps were delivered to the oil company recently. During the next several months Aero Service will compile all the magnetic data in the final form of precise aerial magnetic maps. These maps will be the basis of extensive study and evaluation by Gulf Oil Corporation's geologists and geophysicists. The magnetic data serve as a guide toward areas of particular interest, where necessary ground studies by other methods will be undertaken.

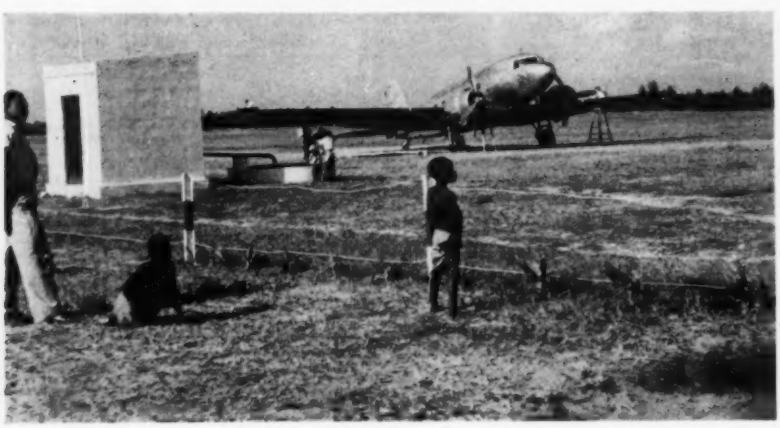
The aerial photographs which were made to guide the survey plane on its airborne magnetometer flights over the concession area are being assembled into photo mosaics for later development planning. The photographs have also been used by Gulf Corporation geologists for stereoscopic study of areas of particular interest.

Aero Service Corporation, whose domestic and foreign aerial mapping is well known in the oil industry, is making the aerial survey under contract with the Mozambique Gulf Oil Company, a wholly owned subsidiary of the Gulf Oil Corporation. Aero Service is the first American company to undertake aerial surveys in Africa.

The aerial survey crew numbers only 10 men: project engineer, chief pilot, co-pilot, crew chief, photographer, a two-man magnetometer staff and three men to process the magnetic data. A modified DC-3, especially equipped and flown from Philadelphia to Africa, was used as the mapping magnetometer plane.

Mozambique Gulf Oil Company has established its operational base for the survey at Inhambane, a small coastal village in southern Mozambique, with a population of less than 5,000, mostly

Aero Service Corp. survey plane at Inhambane.



Survey plane with magnetometer flying over waste sludge piles from Union of South Africa gold mines.

natives. This is the base also for Aero Service's staff, who work under the direction of J. C. Heggblom, Gulf's manager of their native Mozambique exploration program. The village has a grass landing field, which was adequate for the survey plane except during the rainy season. Inhambane's harbor facilities were used for the shipment of survey equipment, spare parts, aviation gasoline and other supplies. The base is located at a central point within the survey area, so that little time was lost in flying to and from the section to be mapped in each day's aerial work.

Inhambane is about 300 miles from Lourenco Marques, the capital of Portuguese East Africa and a noted resort city. This African "Miami Beach" boasts fine hotels, theatres, swimming pools and golf courses, as well as striking modern architecture. Within only 50 miles of Lourenco Marques great elephant herds roam the countryside and all types of game are found.

According to Aero Service's flight personnel, from the air Mozambique resembles the tree-covered coastal plains of the United States. The concession area, located in the southeast part of the country, consists chiefly of grassy flatlands, marked by few rivers and streams and dotted here and there by native villages. The country's climate is like that of Florida, tropical, hot during their summer, and with a rainy season from November to February or March.

The mapping plane, at an altitude of about three miles, covered Mozambique's savanna in a series of overlapping pictures. These were assembled into flight maps. With these maps to guide the magnetometer flights, the magnetic data was observed and recorded accurately in relative positioning. The data was pinned down in absolute positions by integrating the flight maps into a radial plot, related to geodetic positions established by the Mozambique government.

With the high sensitivity instrument developed by the Gulf Research & Development Company, variations as small as two gamma were recorded from the air in a continuous trace. After inspection of the magnetic data by Gulf's field staff, the records were air-shipped to Philadelphia where Aero Service's home office data staff assembles them into precise aerial magnetic maps. Ground methods of collecting magnetic data would require years of work by field parties who would be exposed for long periods to the hazards of African bush operations.

Weather permitted airborne magnetometer flights on an average of five days out of seven. About one day in seven was completely clear of haze and clouds for aerial photographic work. Flying was done about 25 days per month, with the crew's days off on a weather-permitting basis. The plane's position in flight was continuously recorded with the Sonne strip camera, so the flight path can be reconstructed precisely on the photo maps.

The problems of the Mozambique Gulf Oil Company's aerial survey are those found in most foreign work, according to Aero Service. For example, aviation gasoline was needed in large quantities in remote areas where only small stocks are maintained. Supplies must travel over 10,000 miles, a matter of ten weeks or so by boat, or about seven days by air. Complete replacement parts were at hand, for the lack of a small vital part could slow the whole operation, since they could not be obtained locally. Government cooperation was important, and the Portuguese East African government was very helpful in such matters as customs clearances, visas and radio licenses. The Mozambique Servico de Industria Minas e Geologia (Government Department of Mines and Geology) has also been cooperative.

Aero Service spokesmen say that geologists regard many sections of Africa as promising areas for rich finds of minerals of worldwide economic importance, as well as for new oil resources. They believe that the geologic exploration of the African continent is just beginning.

During the rainy season in Mozambique, the Philadelphia company performed a large aerial mapping-magnetometer survey in the Union of South Africa for mining interests, and more exploration work in other areas of the once Dark Continent is being discussed with several other companies. The aerial exploration of Africa has been marked by a solid operational smoothness, and the Gulf air-borne magnetometer continues to perform as a stable, swift reconnaissance tool for the oil and mining industries in this new area.

Wild elephants photographed from survey plane within 40 miles of Lourenco Marques, Portuguese East Africa, where data staff offices were located.

Aerial photograph prints of the Gulf concession area being assembled into flight strips to guide the survey plane's magnetometer flights.

THE OIL INDUSTRY AND SULFUR RECOVERY

By Dr. O. W. Willcox

MANY sour crude oils carry notable quantities of hydrogen sulfide which has to be extracted in a sweetening operation and then flared and vented to the atmosphere. The sulfur contained in this toxic and corrosive gas is thus lost, which is regrettable from a conservation standpoint. During the spring of 1949 there came into operation two plants in the United States for the recovery of sulfur, and several others are in prospect.

One of these plants is located at Wilmington, California, and is operated as a joint-ownership project by the Hancock Chemical Company and The Texas Company in conjunction with refineries owned by three companies—Richfield, Texas and Associated. The working scheme for this arrangement is for each of the three refineries to pass its sour refinery gas into absorbers containing a solution of monoethanolamine, where the gas is stripped of its hydrogen sulfide and carbon dioxide. The foul amine solution is pumped through pipelines to the Hancock sulfur recovery plant. The three streams of amine solution are received at Hancock in surge tanks and the hydrogen sulfide is removed by a stripping operation with steam.

The overhead from the amine solution stripper is hydrogen sulfide with some carbon dioxide and a small amount of hydrocarbons. The stripped amine solution from the bottom of the stripper is piped back pro rata to the three refineries to be used again to absorb more hydrogen sulfide, thus completing the cycle.

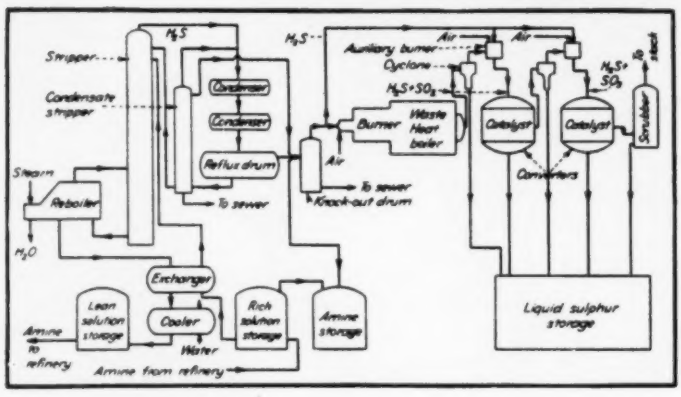
The hydrogen sulfide gas produced at Hancock by the amine stripper passes to a modified Claus unit for the conversion of hydrogen sulfide to sulfur. The basic information for this plant was made available to Hancock and the E. B. Badger & Sons Company, builders of the plant, by Simon Carves Ltd. of England, who had previously built similar plants for the Anglo-Iranian Oil Company to recover sulfur from Iran crudes.

During the recent war McKamie Gas Cleaning Co. built a plant near Stamps, Ark., to remove large concentrations of hydrogen sulfide and carbon dioxide from natural gas. The plant has been producing sulfur on a commercial basis since early in 1944.

The newest sulfur recovery plant in the United States is located in the Elk Basin field on the Montana-Wyoming border and is an integral part of a unitized repressuring project. Here 29 working interests have unitized the Embar-Tensleep and all lower potential horizons, with Stanolind Oil and Gas Company as the operator.

A part of the program laid out in the unit agreement required the maintenance of reservoir pressure to assure maximum ultimate production of crude oil from the field. In that region water

Stripping column condensers and reflux drum in foreground. Catalyst chambers and scrubber are shown at right of stack of Hancock Chemical Co. plant at Los Angeles.



Flow diagram of Hancock Chemical plant.

is too scarce to allow water-flooding. To return the hydrogen sulfide-laden gas to the formations was inadmissible. On the other hand, it was found that when the casinghead gas was sweetened and compressed, its volume would shrink to such an extent that the amount of residue gas would not provide adequate pressure maintenance. Under these circumstances the only way to procure inert gas for repressuring would be to produce it as flue gas in steam raising operations. A part of the necessary flue gas could be had from a special boiler under which the hydrogen sulfide is burned to sulfur dioxide and the rest by burning sweet residue gas in an ordinary boiler plant. The special arrangements required for obtaining repressuring gas of proper quality are among the more interesting engineering features of the project.

The design of the plant* required the production of 14,000,000 standard cubic feet of suitable boiler flue gas a day for injection into the reservoir and the processing of 12,000,000 SCF per day of casinghead gas for production of plant fuel and the recovery of liquid hydrocarbons and sulfur. Stone & Webster Engineering Corp. were the contractors for the job.

A favorable factor in the recovery of sulfur at Elk Basin is the high content of hydrogen sulfide in the casinghead gas. At the time of discovery of the Embar-Tensleep reservoir, this casinghead gas contained the highest concentration of hydrogen sulfide encountered in any known production. (See Tables 1 and 2).

The Embar-Tensleep reservoir now produces from 124 wells ranging in depth from 3,900 to 6,000 feet. Casinghead gas is collected from elevated separators at nine crude oil tank batteries in the field. The gas collection system is installed aboveground and is sized to deliver gas to the plant compressors at a pressure slightly above atmospheric, with field separators operated at two psig. Vacuum operation is avoided in order to prevent possible air infiltration and thereby minimize potential corrosion by hydrogen sulfide. Low points in the collection system are equipped with underground drip collection tanks from which pumps, controlled by float-operated switches, deliver the drips to a surge tank at the plant. There are six such drip collection points from which small pipelines run to the plant paralleling the gas collection system.

The plant design provides for the extraction of H_2O, CO_2, gasoline, butane and most of the propane from 12,000,000 SCF per day of casinghead gas, producing a fuel gas suitable for plant boilers and compressors, a residue gas in salable form at 500 psig, commercial sulfur, and noncorrosive boiler flue gas at 1500 psig for injection into the Embar-Tensleep reservoir.

As may be seen from Table 1, the sweetening of the field gas by removal of H_2S and CO_2 leaves a gas rich in propane and heavier hydrocarbons. For recovery of these hydrocarbons, a number of process cycles were studied. The absorption cycle selected consists of a single intercooled high pressure absorber followed by (1) a reboiler-absorber (demethanizer) operating at a lower pressure for partial stabilization of the rich oil, and (2) a single still for stripping the heavier absorbed hydrocarbons from the absorption oil. A study of plant and field conditions indicated that the plant should be designed for 80 percent propane recovery. Design product quantities are shown in Table 2.

In conjunction with the preparation of inert gas, a steam power plant is provided to produce steam and electricity for the plant and part of the electric power required by the field; additional electric power required for the field and standby for the plant is purchased from outside sources. Boiler flue gas is dehydrated and compressed to 1500 psig for injection.

Water for the plant, available from the system that was installed during the development of the reservoir, is pumped from the Clark's Fork River, which is approximately 15 miles west of the field in the Absaroka foothills. Since plant make-up water is limited by this system to 5,000 barrels daily and because air temperatures are quite low in this region, a large portion of the cooling is accomplished by air-cooled units.

The plant field gas compressors (Fig. 1) consist of three, three-stage, 1,000 hp gas-engine driven units designed to compress a total of 12,000,000 SCF per day from 12.7 psia to 540 psia. Because of the 4,962-foot altitude, these compressors are derated to approximately 860 hp each.

Field gas enters the plant through a scrubber designed to remove entrained crude oil, scale and other foreign materials. Gas from this scrubber flows to the first stage suction header at 0.5 psig. The first stage discharge gas is cooled, passed through a separator and sent to the "low-pressure" amine absorber, where it is partially stripped of hydrogen sulfide and almost completely stripped of carbon dioxide. The gas is then further compressed to 152 psig in the second stage, cooled, passed through a separator and treated in the "high-pressure" amine absorber for hydrogen sulfide removal to a maximum residual concentration of 0.25 grains H_2S/100 SCF. The sweet gas is then compressed in the third stage to 525 psig, passed through the third stage after-cooler and charged to the main absorber. One of the inert gas injection compressors is manifolded to serve as a spare for the field gas compressors.

A flow diagram of the H_2S removal system is indicated in Figure 2. Because of the high acid gas (H_2S and CO_2) content, it was found desirable to use a two-stage amine process for sweetening. This system removes hydrogen sulfide and carbon dioxide from the field gas by contact with a water solution of monoethanolamine in 21-tray contactors or absorbers installed at the discharge of the first (46 psig) and second (152 psig) stages of compression.

The first stage amine absorber reduces the hydrogen sulfide content to approximately 100 grains/100 SCF, and the second or final clean-up stage produces a gas which will pass the lead acetate test. The rich amine solution with its load of acid gas is pumped through heat exchangers to the reactivator where the H_2S and CO_2 are stripped from the solution by steam vapors generated in the reboilers. The reboilers are heated with extraction steam from the power plant.

For better heat economy a "split flow" amine system is used. About half of the rich amine enters at the top of the packed reactivator, and the remainder enters at the mid-point of the tower. A stream of partially stripped or semi-lean solution, withdrawn immediately above the middle of the reactivator, exchanges heat with the feed and is pumped through coolers to the "low-pressure" absorber, entering the 15th tray from the bottom. The completely stripped or lean solution from the bottom of the reactivator exchanges heat with the feed and is pumped through a cooler. From the cooler, this stream splits, half entering the "high-pressure" absorber on the 19th tray and half entering the low-pressure absorber on the 18th tray from the bottom. The rich solution from the bottom of the high-pressure absorber, having a relatively low acid gas content, is added with the semi-lean solution to the low pressure absorber. A water-wash stream from the discharge of the reactivator reflux pump enters the top tray of the low-pressure absorber, and a separate water wash stream, stripped of acid gas, enters the top tray of the high-pressure absorber, thus minimizing amine loss to the gas streams. Splitting the flow of the rich and lean solution streams in the above manner results in a reduction of reactivation heating and cooling loads.

Overhead vapor from the reactivator is cooled to approximately 115°F; the condensed water is pumped back to the tower as reflux, and the acid gas flows to the sulfur recovery unit.

The process design for the H_2S removal system was developed by the Girdler Corporation.

Table 1

Feed Gas of Elk Basin Plant

Components	Mol. %	Mscfd
Nitrogen	2.00	240
Carbon Dioxide	6.00	720
Hydrogen Sulfide	18.50	2220
Methane	41.75	5010
Ethane	15.50	1860
Propane	7.41	889
Butanes	5.20	624
Pentanes and heavier	3.64	437
Total	100.00	12,000

Table 2

Products of Elk Basin Plant

Propane	19,100 Gal./Day
Butane	20,200 Gal./Day
Natural Gasoline	16,900 Gal./Day
Sales Gas @ 500 Psig	4,200,000 SCF/Day*
Inert Gas @ 1500 Psig	14,000,000 SCF/Day
Sulfur	74 Long Tons/Day

* Includes inert gas dilution to 1000 Btu per SCF (dry).

* A full description of the design features of the Elk Basin plant as a conservation project is contained in a paper by L. R. Lyon, R. A. Feagan and H. B Manley, presented before the Rocky Mountain Division meeting of the API in Casper, Wyoming, May 27, 1949. The present article is concerned mainly with the arrangements described by these authors for recovering sulfur and obtaining repressuring gas.

Sulfur has several rather unusual properties which must be kept in mind when considering the design of the sulfur recovery system. At room temperature the stable crystalline form of sulfur is rhombic; at about 200°F this form transforms to the solid monoclinic form, and sulfur melts at approximately 240°F. At the melting point sulfur is a straw-colored liquid of low viscosity, and as the temperature is increased, the viscosity decreases slightly up to a temperature of about 320°F. With further heating the viscosity rapidly increases from about 40 centipoises at 320°F to more than 2,000 centipoises in the region of 400°F, and then decreases again as the temperature rises above 400°F. Thus, at 320°F sulfur is easily handled as a liquid in pumps and plant piping, but at 400°F it is a heavy plastic material.

Design of the Elk Basin sulfur recovery system is based on a modification of the Claus process. Variations of this process have been used for a number of years in Europe, but only recently has it been commercially developed in the United States.

In the Elk Basin plant acid gas from the amine unit, containing approximately 75 percent H_2S and 25 percent CO_2, enters the sulfur recovery unit through a scrubber which removes entrained water (Fig. 3). Part of the acid gas from the inlet scrubber is burned with controlled air in a specially designed boiler to produce sulfur dioxide, utilizing the heat of combustion to generate 200 psig saturated steam. The combustion chamber of this boiler is operated at a pressure sufficiently high (about three psig) to force the combustion products through the remainder of the process without blowers or compressors. Combustion products from the boiler containing sulfur dioxide are commingled with the unburned portion of the acid gas and pass to the first reactor, which contains a bauxite catalyst. The design inlet temperature of the reactor is 450°F.

Reduction of sulfur dioxide and oxidation of hydrogen sulfide occurs over the catalyst, releasing elemental sulfur. The heat of reaction raises the temperature to approximately 740°F, and at reactor-exit conditions the sulfur is in the vapor state.

The reactor gases are cooled to approximately 300°F in a condenser-separator which condenses the sulfur vapor and generates low pressure steam at approximately 35 psig. Reaction is not completely effected in one reactor; therefore, the remaining unreacted gases are reheated above the sulfur dewpoint to a temperature of 450°F in a gas fired line-heater and pass to a second reactor where the reaction proceeds substantially to completion. The exit gas from the second reactor flows to a second condenser-separator where the sulfur vapor is condensed at about 300°F.

The non-condensed gas, which should contain less than one percent H_2S, is exhausted to the atmosphere. The condensed liquid sulfur flows from the conical bottoms of both condenser-separators to a surge tank and is pumped to storage through a steam jacketed line.

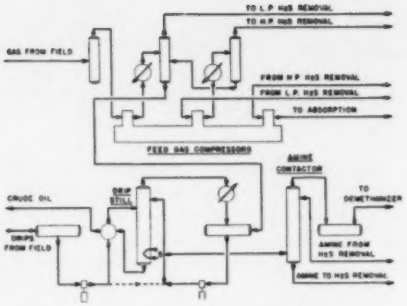


Fig. 1. Compression drips. Elk Basin plant.

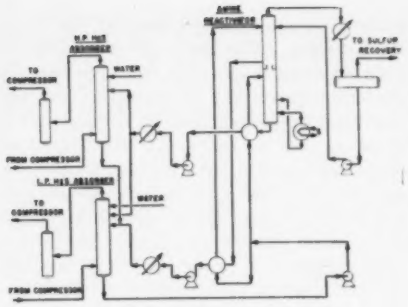


Fig. 2. H_2S removal. Elk Basin plant.

A small auxiliary heater is provided to burn any potential accumulation of carbonaceous materials from the catalyst beds. This unit also serves as a start-up heater.

The important combustion reaction is:

$$H_2S + 3/2\,O_2 = H_2O + SO_2$$

The reaction over the catalyst is:

$$2H_2S + SO_2 = 2H_2O + 3\,S$$

The reactors are Lumnite-lined cylindrical vessels about 16 inches in diameter, with six-inch catalyst beds. Gas flow is downward through the 4-8 mesh bauxite catalyst, with a design space velocity of roughly 250 SCF/CF Catalyst/Hour. The catalyst bed is supported by a stainless steel grating and wire mesh. To minimize corrosion, an alloy of 18-8 stainless steel is used in the effluent piping from the reactors and for lining the inlet channels of the condenser-separators.

The sulfur-free gas from the third stage of the field gas compressors enters the main oil absorber (Fig. 4) where approximately 90 percent of the propane and substantially all heavier hydrocarbon components are extracted by the absorption oil at a pressure of 520 psig. The design oil rate to the absorber is 98 gpm. One intercooler is used to limit the overall temperature rise of the oil to 20°F, thus reducing the required oil circulation rate.

Rich oil from the absorber, together with treated compressor condensate and drip gasoline, enters the 14th tray of the demethanizer, which is operated at a pressure of 163 psig. Part of the lighter absorbed hydrocarbons flash and rise through the tower, while the remaining rich oil flows down through the 14-tray stripping section of the tower to the reboiler. In the stripping section vapors from the reboiler remove methane and some ethane from the rich oil. These vapors, along with the flashed vapor from the feed, enter the 24-tray absorption section where the propane loss to the residue gas is controlled by introduction of lean oil to the top tray at a design rate of 40 gpm.

The residue gas from the main absorber (except that quantity used for fuel) is cooled and dehydrated in a solid desiccant dehydration unit to meet sales gas specifications. Inert gas may be added to control the heating value at 1,000 Btu/SCF before delivery for sale at 500 psig. Residue gas from the demethanizer, augmented by the required quantity of residue gas from the main absorber, is used as plant fuel. The absorbed hydrocarbons are separated from the lean oil by steam stripping at 110 psig in a 20-tray still. The design stripping steam requirement is 2,920 pounds per hour.

Heat is added to the still by a reheater which utilizes 400-pound steam. The stripped lean oil flows through a heat exchanger, the demethanizer-reboiler, and coolers to the lean oil surge tank from which pumps return the oil to the main absorber and the demethanizer. The hydrocarbons stripped from the oil in the still are condensed as an overhead product, the end-point being controlled by reflux pumped back to the top tray. Normally there will be no uncondensed vapors from the still accumulator because of the removal of methane and a large part of the ethane in the demethanizer.

The unstabilized gasoline from the still accumulator is pumped to the depropanizer (Fig. 5) which operates at about 310 psig. The liquid overhead product from the depropanizer, a mixture of ethane and propane, is fractionated in the deethanizer which operates at 540 psig to yield commercial propane as a bottom product and ethane-propane vapor overhead. The latter may be recycled through the main absorber to recover the small amount of propane it contains, or sent to the main absorber residue-scrubber where it joins the residue gas going to the fuel or sales gas system.

Partially stabilized gasoline from the bottom of the depropanizer is treated with caustic for mercaptan removal and flows to the debutanizer, operating at 110 psig. The overhead from the debutanizer is condensed and the liquid butane product flows to storage through a cooler. The controlled vapor pressure natural gasoline from the bottom of the debutanizer is cooled, sweetened and pumped to storage. The propane product is treated in a single-stage non-regenerative caustic contactor for removal of any H_2S which may have escaped the amine unit, dehydrated over the bauxite and then delivered to storage.

The high mercaptan sulfur content of the Embar-Tensleep gas makes it impractical to treat the gasoline in a conventional fixed bed copper chloride treater without a pretreatment to reduce the mercaptan content; therefore, the combined butane and gasoline product of the depropanizer flows to a packed caustic contactor for removal

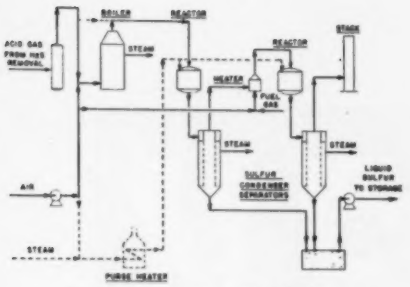


Fig. 3. Sulfur recovery. Elk Basin plant.

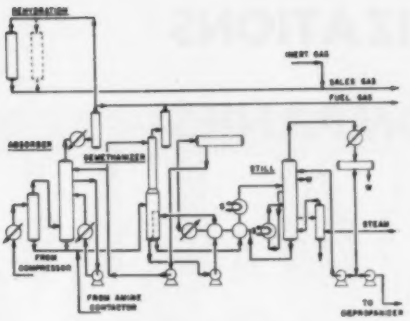


Fig. 4. Absorption distillation. Elk Basin plant.

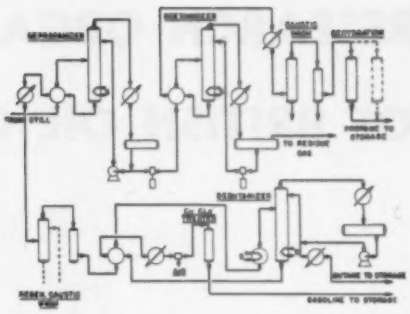


Fig. 5. Fractionation-product. Elk Basin plant.

of lower molecular weight mercaptans and traces of hydrogen sulfide. Spent caustic from the bottom of the contactor is regenerated by steam stripping in a packed tower. Final sweetening of the natural gasoline product from the bottom of the debutanizer is accomplished in a fixed bed copper chloride treater.

Sour drips formed by condensation in the gas collection system during cold weather and at night are pumped into a surge tank in the plant. The drips are pumped from the surge tank through an amine contactor for removal of hydrogen sulfide and then join the rich oil feed to the demethanizer. Lean amine from the hydrogen sulfide removal system is charged to the contactor and rich amine is returned for regeneration.

If crude oil is present, the drips may be charged to the drips still to prevent contamination of the absorption oil. The drips still operates at 18 psig and is designed to handle 5,000 gallons per day. A gasoline fraction is produced as an overhead product and pumped through the amine contactor to the demethanizer. The heavy bottoms product flows to the heavy oil slop tank.

One of the Elk Basin plant boilers is designed for inert gas generation. It is equipped for close combustion control in order to operate the boiler with a small amount of carbon monoxide and no oxygen in the flue gas. Presence of oxygen is avoided throughout the inert gas system in order to prevent oxidation of the H_2S in the reservoir and possible plugging of the injection wells with elemental sulfur.

The combustion chamber of the boiler is enclosed in a gas-tight steel casing in which cool flue gas is circulated for cooling the boiler setting and preventing air infiltration. With vacuum operation avoided throughout the system in order to prevent air infiltration, the combustion chamber is operated at a positive pressure of four to six inches of water. An economizer reduces flue gas outlet temperature to about 400°F. A booster blower delivers the inert gas through coolers to the injection compressors at about 0.5 psig. Water condensed from the flue gas may be recovered and pumped to the cooling tower basin or boiler feed-water.

There are five four-stage, 1200 HP (sea level rating), two-cycle, right-angle, gas-engine-driven injection compressors designed to compress a total of 15,000,000 SCF per day of inert gas from 12.85 psia to 1,525 psia. The design provides that 1,000,000 SCF per day of inert gas be withdrawn from third stage discharge for sales gas dilution to reduce the heating value of the sales gas to 1,000 Btu/SCF.

The inert gas is delivered by the four stages of compression through interstage coolers and scrubbers to the field injection piping system at 1,500 psig and 165°F. Between the second and third stages (130 psig) of compression, a solid desiccant unit dehydrates the injection gas, thereby eliminating potential corrosion.

Several methods were considered for the handling and storage of sulfur. One of these was the use of a belt conveyor for atmospheric cooling and solidification, the sulfur being broken off in flakes at the end of the belt. The efficiency of this technique is attractive for longtime operation, but the possibility of a market for liquid sulfur in the near future has resulted in selection of the simplest and least expensive method for initial operations.

Molten sulfur from the sulfur extraction unit is delivered through a steam jacketed line to the sulfur storage area. There the sulfur is discharged into a temporary sheet-metal vat, where it solidifies by atmospheric cooling. The sheet metal is removed and the solid cake of sulfur is blasted, loaded into trucks and hauled to a rail siding at Powell, Wyoming, where conveyors are provided for intermittent loading into boxcars.

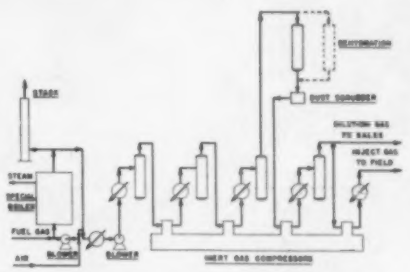
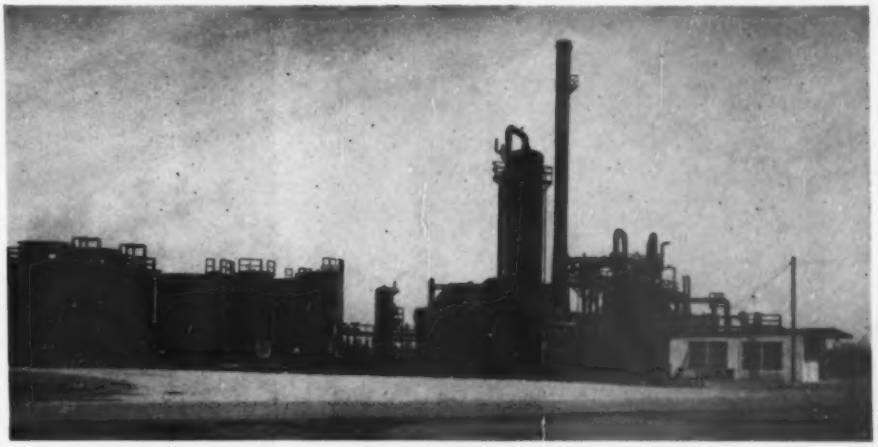


Fig. 6. Inert gas system. Elk Basin plant.

It is believed that the Elk Basin plant is an outstanding example of modern conservation practice. The project provides not only for recovery and utilization of the hydrocarbons from the sour casinghead gas, but also provides for pressure maintenance of the Embar-Tensleep reservoir in the Elk Basin field by the injection of special boiler flue gas and the production of sulfur from hydrogen sulfide, a gas which is commonly flared in such plants.

Two major refiners in the Los Angeles area have extracted hydrogen sulfide from cracker fuel gas for a number of years. In these cases the acid gas extract is piped to adjacent chemical plants for conversion to sulfuric acid. More recently, The Texas Co. announced that hydrogen-sulfide-containing waste gases from its Eagle Point refinery at Westville, N. J., will be used in a new 40-ton-per-day sulfur recovery plant to be built there.



General view of Hancock Chemical Company's sulfur recovery plant.

RESEARCH ORGANIZATIONS OF BRITISH OIL COMPANIES

By E. Lawson Lomax

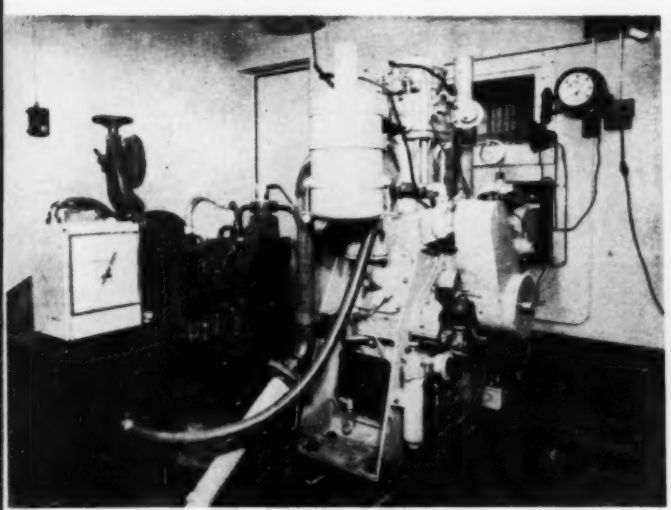
In the July issue of World Petroleum Mr. Lomax described the research activities of Anglo-Iranian Oil Company, Manchester Oil Refinery and the Burmah Oil Company. The accompanying article dealing with Shell and Esso concludes the present series.—Editor.

Research activities of Anglo-American Oil Co. Ltd., conducted by Esso Development Co. Ltd., were evacuated from Vauxhall during the war to a 150-acre estate near Oxford where Esso House, pictured above, is surrounded by numerous laboratory buildings and cottages. Here the researchers work under most pleasant conditions surrounded by beautiful gardens and park land.

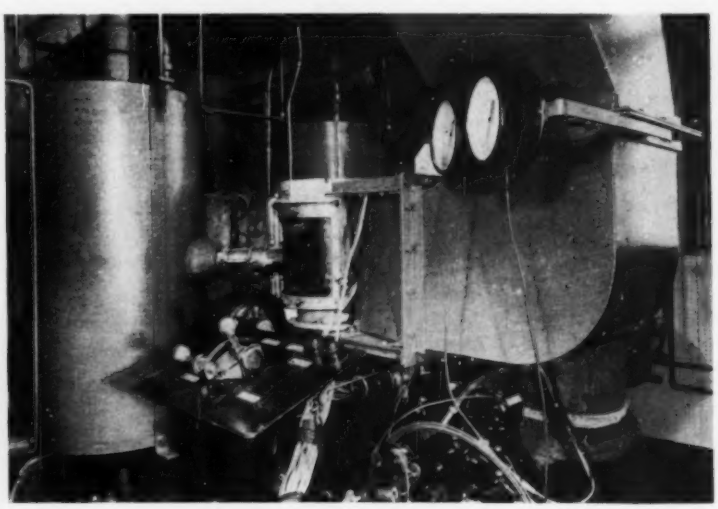
THE Shell research center at Thornton-le-Moors, Cheshire, was inaugurated in the period immediately preceding the late war, when an aero engine research laboratory was planned at Thornton with the object of keeping pace, by the development of petroleum fuels and lubricants, with the demand by designers and users for more powerful, economical and reliable aero engines. Construction date was 1940, and full operation was attained in 1942. During the war it was engaged on government work and acted as Ministry of Aircraft Production, Fuel and Oil Research and Development Laboratory.

Between 1943-1945, expansions were made and new laboratories were built to deal with chemical and metallurgical work, further engine test units, problems concerned with fuels and lubricants for motor cars and diesel engines, specialized lubricants for industry, solvents and chemicals from petroleum and pilot plants for development of industrial processes. After the war in 1947 all the units were welded into the present research under control of a director of research. Later a new fuel laboratory was installed, and on completion of this the research center was formally opened on May 20, 1948.

Caterpillar single-cylinder diesel engine used for testing heavy duty lubricants at Esso Development Co. laboratories.



Hercules sleeve-valve aviation engine used by Esso Development in the development of improved aviation type oils.



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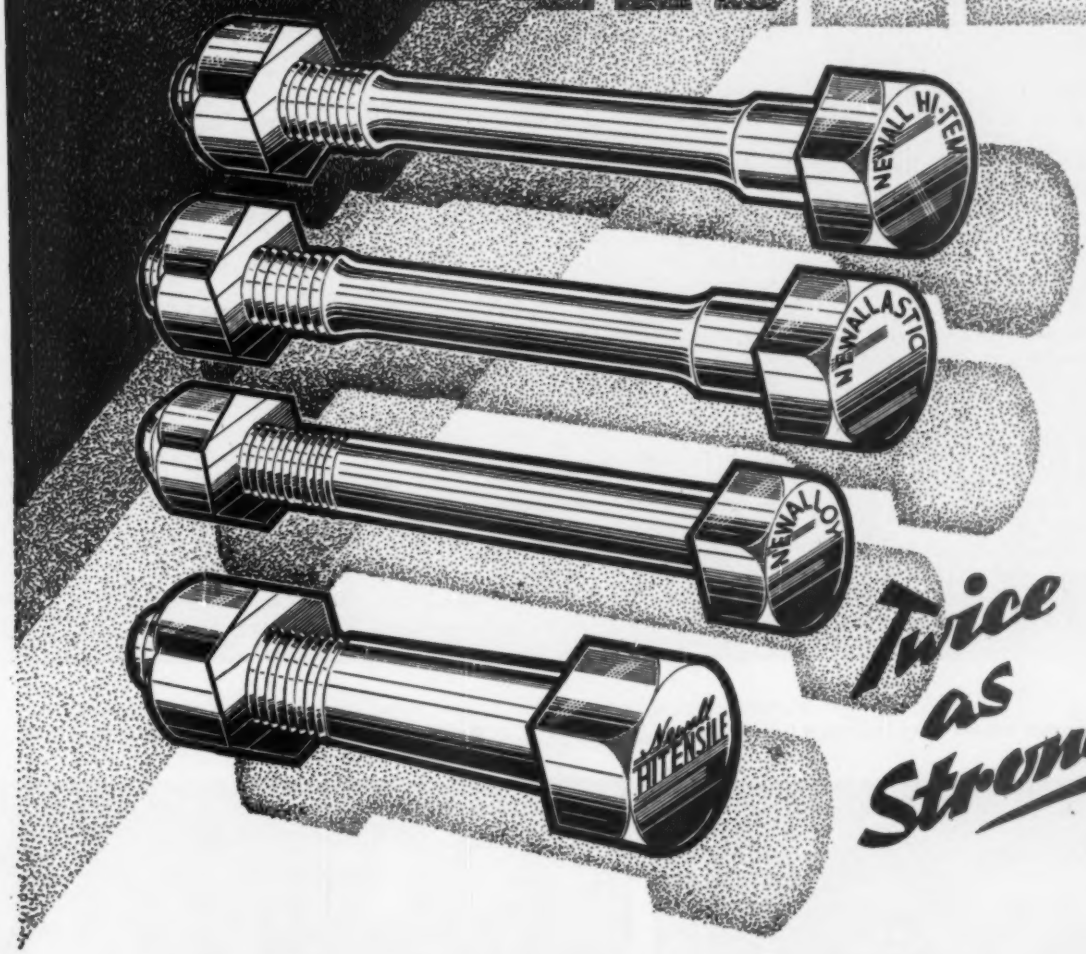

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The laboratories stand on a 30-acre site and have a floor space of 730,000 feet, where 78 engines of different types are housed in the different sections, as well as a number of plants and appliances for small scale work. The staff of the center numbers nearly 900, of which 323 are qualified technical staff, the remainder being in workshops, technical services and administration.

During the war valuable work was carried out for the War Office on the vital problem of getting valves of engines to stand up to the sudden heavy increases in the tetraethyl lead contents of gasoline supplied to the forces. This problem was satisfactorily solved.

Experiments with selected high octane fuels, as part of the study of fuel characteristics essential for better road performance is one of the many problems under investigation at present, as well as study of the problem of obtaining more even distribution of the tetraethyl lead in fuel between the individual cylinders and automobile engines fitted with carburetors; replacement of carburetors by direct injection with the object of reducing fuel consumption, especially at part-loads; road tests of prototype and production cars to ascertain the gasoline quality requirements of British cars and to assist manufacturers in designing engines to give good performance on fuels at present available; also to gather information on the engine performance of various components which make up gasoline. The problem of "running on," which happens where the present grade of gasoline is used in some cars of recent design, is also being studied.

The field of aviation presents special problems, both in lubricants and fuels, particularly as the emphasis gradually is moving from piston engine to the gas turbine or jet engine involving the utilization of a wider range of fuels. The study of combustion efficiency by new techniques is being developed. A definite problem exists when flying a jet-propelled plane at its most economical height in the stratosphere, which is the difficulty of keeping the burners alight in such a rarefied atmosphere. This is being tackled by the evolution of special fuels and by intramolecular rearrangement of existing products to improve their inflammability.

Lubricants for aircraft engines also come in for considerable attention, as the ease of starting an engine at low temperature depends to a great extent on the lubricating oil. For this purpose a cold room is available large enough to accommodate a complete aero engine or motor car with lubricating oil tanks in which the temperature can be reduced to —40°C in order to study the problems of starting under sub-zero conditions such as prevail in arctic and antarctic regions. This aviation laboratory also houses a number of machines and engines designed to measure the performance characteristics of various oils under different conditions.

The problems in the diesel fuels section deal with the use of heavier fuels for medium and high-speed engines to replace gas oils and other distillate fuels which are in great demand for other purposes; and with the effective use of fuels of low ignition quality, which in general give better fuel consumption and power output than those of high octane value, but under normal conditions in high speed engines may result in rough running. Pilot ignition exploits the use of such fuels, increasing their ignitive quality without reduction of their good performance qualities. Electronic equipment by which the rise and fall in cylinder pressure during operation is shown by a radar-like trace on a screen, is used successfully to show the effect of pilot ignition, the operator being able to examine the conditions in the cylinder almost as well as if the walls were transparent. The protection against corrosion caused by diesel fuels of high sulfur content has been studied in various ways, including the addition of agents into the fuel or the lubricant, but the metallurgical approach seems to offer the possibilities, and a protective coating has been developed which promises a satisfactory solution.

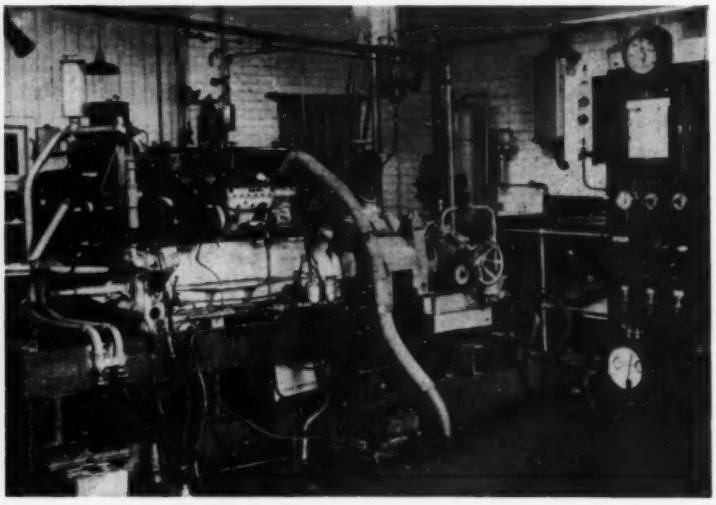
In the lubricating section is a complete equipment for the testing of lubricants, both liquid and solid, under varying conditions in spark and compression-ignition engines as well as under industrial conditions. Extensive studies are being made on high-load carrying lubricants such as extreme pressure oils, the actions of additives, the development of improved lubricants for internal combustion engines, the problems of gear lubrication at high and low speeds, the improvement of oils for steam cylinders and industrial bearings, metal working and metal cutting oils. The study of electrical lubricating oils, cable oils and greases is also given close attention by a special section.

In the chemical division, in addition to the analysis of petroleum products and the examination of new and used lubricating oils, new uses are studied for the products and by-products of the refineries, and the production of chemicals from petroleum sources is very closely followed. The products made include "Dutrix," a plasticizer for polyvinyl chlorides and rubber, solvents such as alcohols and ketones, detergents such as Teepol, wetting agents, anti-rusting compounds, varnishes and perfumes from olefines.

Esso European Laboratories, the research section of the Esso Development Co., Ltd., are part of the well-known system of Esso laboratories of the Standard Oil Development Co., the affiliate of Standard Oil Co. (N. J.) responsible for research and development. Inaugurated in 1935, the laboratories were installed in buildings at Vauxhall, London, to contribute to the research activities of the Esso organization in Europe. These laboratories were equipped with engine test beds, controlled temperature rooms, chemical laboratories And workshops—in fact, all of the usual equipment required for investigational work on fuels and lubricants.

Esso Development laboratory equipped for the inspection of fuels and lubricants.

Diesel engine test bed at Esso Development laboratories.



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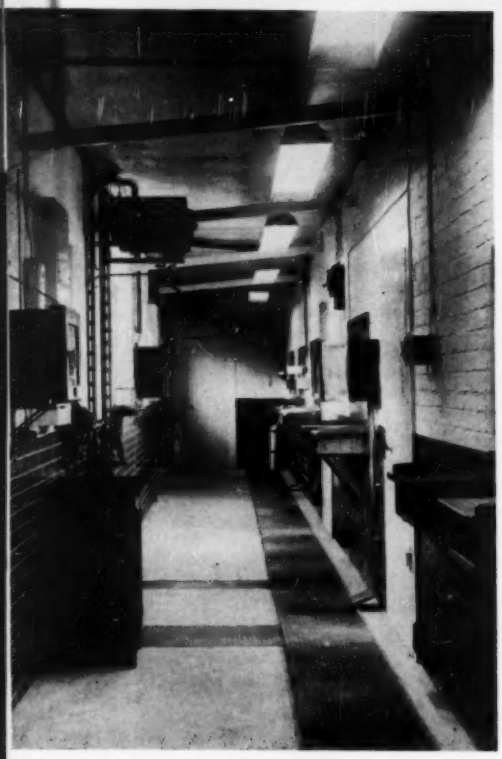
In the early days of the war it was necessary to expand the laboratory facilities to enable investigational work to be conducted in connection with the development of aircraft fuels and lubricants. Because of the vulnerability of the Vauxhall laboratories, it was decided to install equipment in buildings on an estate purchased by the Anglo-American Oil Co., Ltd., the United Kingdom affiliate of the Standard Oil Co. (N. J.) for evacuation of office staff. The estate, which is situated at the foot of the Berkshire Downs 10 miles south of Oxford, includes an attractive mansion which, together with numerous buildings and cottages, stands in the midst of 150 acres of gardens and park land. A delightful picture of the Esso House, as the mansion is now called, is shown in the photograph on page 46. This is undoubtedly an ideal situation for a research organization, and, with the end of the war, it was decided to transfer as soon as possible the whole of the company's research activities to this estate.

Exterior view of one of the engine testing buildings at Esso Development laboratories.

Control room for Engine Laboratory No. 2 at the Esso research center.



It is intended when conditions permit to construct a new laboratory building in which all sections of the organization can be housed under one roof. In the meanwhile, however, until the present building restrictions are lifted, the fullest use is being made of the existing estate buildings; and these, together with a number of temporary buildings originally erected to provide office accommodation, house the various laboratories, reference library, machine and repair shops and other departments which go to make up the modern petroleum research organization. In adapting the estate for its present purpose, care has been taken to preserve the original amenities and the exteriors of most of the buildings are unaltered.

Esso European Laboratories work in close liaison with other labortories of Standard Oil Development Co. in the United States but pay particular regard to problems arising out of the refining and marketing activities of the Jersey company in Europe. It is natural, therefore, that a large part of their activities should concern the performance of petroleum products in European equipment. As more than half of the total European consumption of petroleum products is used for automotive purposes, the facilities include a number of laboratories equipped with engine test beds, dynamometer brakes and all the ancillary apparatus and instrumentation required for conducting engine tests. These laboratories are in general divided into sound-proof cubicles, each capable of taking one, two or three engines according to the nature of the work. The expense involved in subdivision and in treating with sound-absorbing materials is considered worth while, not only from the aspects of safety and comfort to the operating staff, but also in maintaining the high standards of cleanliness which are desirable to ensure accurate work. Many of the engine test beds are of standardized design and are used for the routine inspection of fuels and lubricants. The Standard knock test engines are an example of this type of unit, as also is the Caterpillar single-cylinder diesel engine used for the routine testing of heavy-duty lubricants, shown in the photograph. Other engine test beds are designed to be as flexible as possible in the type of engines which they can accommodate, so that any equipment suspected of being particular in its required fuel or lubricant can be mounted in the cubicle and studied under controlled conditions.

An interesting type of coil-spring-mounted, steel frame bed is used for most applications of this kind. In exceptional cases, however, particularly for the high-powered, single-cylinder engines, much heavier test beds must be used. For convenience these are sunk into the floor. An example of such a unit is shown in the photograph. This unit is a reinforced concrete bed of some 20 tons total weight and is at present carrying a single-cylinder Hercules sleeve-valved aviation engine which is being used for developing improved oils for aircraft purposes. This particular engine bed was used continuously during the early part of the war on the investigation of aviation fuels of high knock rating required for Allied aircraft.

Although bench testing of single-cylinder and full-scale engines is an essential step in the development of improved fuels and lubricants, field testing must always be resorted to before the products are acceptable to the marketers. For this purpose the laboratories maintain a fleet of test cars instrumented to give full data on engine temperatures, speeds, ignition timing, detonation tendency, etc. These are in constant use in the road studies of detonation and in the observation of the effects of lubricants of different types on engine life.

Notable features of the engine laboratories are controlled temperature rooms. The larger of these is big enough to accommodate a motor coach chassis and can be operated over a temperature range of from —20°F to +120°F. It is equipped with a chassis dynamometer for measuring road speeds and powers and an air circulation system for simulating windage effects on the road. It is possible in this room to carry out controlled tests on motor vehicles over a wide range of driving conditions. The smaller room is of about 10 cubic foot capacity and can be operated down to a lower temperature of —40°F. Both these rooms were in great demand during the war for low-temperature testing of all types of military equipment, such as aircraft hydraulic systems, armaments and engines.

A separate laboratory building on the Esso House site is allocated to the operation of semi-technical equipment. Besides specific pilot plant, this building accommodates conventional chemical engineering equipment, such as distillation columns and clay contacting plant for the preparation of the test fuels and lubricants required in other parts of the laboratories.

The conventional research laboratories are equipped to permit study of the full range of petroleum products and contain many interesting pieces of test equipment. Notable among these are a very low temperature cabinet for testing products under simulated high-altitude conditions, equipment for studying the combustion of fuels under different pressures and for testing lubricants of unusual high viscosity index and load-carrying capacity.

The analytical laboratory is equipped to carry out all the petroleum test methods standardized by the A.S.T.M. and the Institute of Petroleum and many of the tests peculiar to some of the European countries. A nucleus of skilled analysts practice all the modern analytical techniques and pay particular regard to the developments of the last decade in physical methods, particularly the spectographic methods used for analysis.

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Covering shore end of the line which is laid to a loading point nearly a mile off-shore in the Gulf of Lyon. Photographs by Clement, Sète, France.

FIRST EUROPEAN "SEA LINE"

SUBMERGED oil pipelines are no novelty to American petroleum engineers, but until the latter part of 1948 nothing of the sort was known in Europe, with the exception of the cross-Channel line known as "Operation Pluto" for supplying oil and gasoline to the Allied forces in the Normandy invasion.

The enterprise which for the present has the honor of being the first and only European sea line for peacetime use was completed last September in the Gulf of Lyon near the French port of Sete to enable tankers of large draft to deliver crude oil to the Frontignan oil refinery. Prior to World War II this refinery had a capacity for handling 240,000 tons of crude per year. After the war it was reconstructed for a yearly capacity of 600,000, but the small port of Sete, which can be approached only by vessels of shallow draft, was inadequate for handling the increased supply.

It, therefore, became necessary to lay an underwater line out into the gulf where the largest tankers could anchor in 46 feet of water and discharge their cargoes. The total length of the line is 8,761 feet, of which 4,936 feet is under water; the land portion of the line from the water edge to the refinery is 3,825 feet long. The pipe itself is made of 12-inch steel I.D., 11⅓-inches, weighing about 30 pounds per running foot, delivered in lengths of about 10 meters (32 feet).

For convenience in welding the pipe sections, a graded earthen platform about 4,000 feet long and 20 feet wide was built paralleling a rail spur to the shore and was surfaced with a well rolled layer of crushed rock from a neighboring quarry; part of this platform had to be built over a quaggy pond. Construction of the platform required the placement of 20,000 cubic yards of fill and was completed in five weeks. The whole work on the project was under the supervision of R. G. Colby, the American engineer who had charge of "Operation Pluto," and was finished in four months.

Rails were laid on the platform to accommodate small trucks on which the joints of pipe as received were unloaded. The joints were first about 64 feet long. Three of such lengths were welded together two by two, making sections then wheeled into line on the trucks so that their ends could be welded and then rolled off the trucks on to wooden supports of the same height as the trucks, placed 15 feet apart, whereon the welding of the whole sea length of the line was completed.

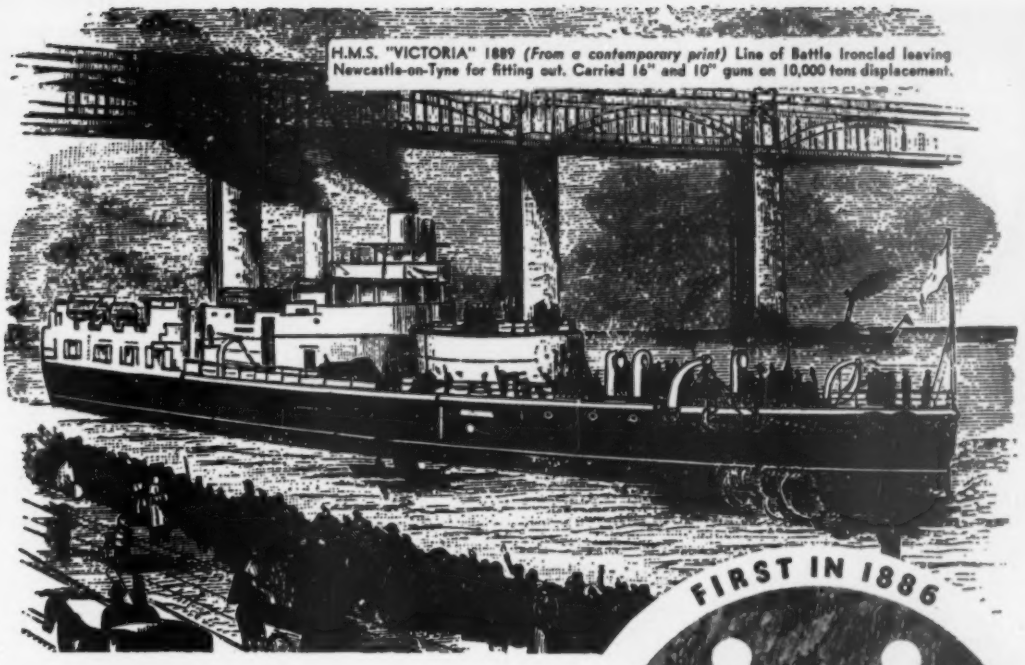
The "Y," with two flexible eight-inch tubes which receive the oil from the tanker at the unloading station out in the water, was welded on the seaward end of the first section. The whole line was hydraulically tested at 100 pounds per square inch.

The line was given two layers of bitumen-base paint applied cold, and then a ⅛-inch coat of enamel applied at 250°. It took 4,000 manhours to do the job of painting and coating.

When everything was ready, a 12,500-ton British tanker, the "Royal Duke," was anchored out where the "Y" was to be placed. In addition to the hold on the sea bottom provided by the ship's anchors, two caissons were sunk, and the ship was lashed to them; these provisions were further reinforced by two tugs to help hold the tanker in place. A ¼-inch wire rope was taken from the shore to the tanker, where its end was tied to a 2¾-inch steel cable coiled on a big winch aboard the tanker. The big cable was pulled ashore and fastened to the "Y." The winch began to turn, and the pipeline, gliding along over wooden rollers provided for it on the earthen platform, was hauled into place. This operation took about five hours. The seaward end was then welded to the land end.

"Y" with cable attached just prior to launching of the sea line.

Assembled and welded sections of the line on trucks ready for launching.



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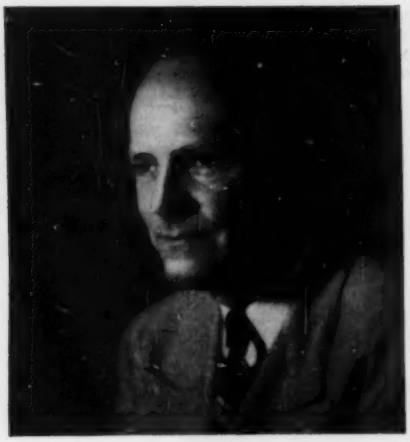

Howard W. Page

David A. Shepard

HOWARD W. PAGE, executive assistant to the president of Standard Oil Co. (N. J.), has been appointed shareholders' representative for Standard affiliates in the United Kingdom, to take effect in October. David A. Shepard, who has been shareholders' representative and chairman of the board of directors of Anglo-American Oil Co., Ltd., will succeed Mr. Page as executive assistant to President Eugene Holman. R. A. Carder, of London, managing director of Anglo-American, will become board chairman of that company.

Mr. Page has had wide experience with the company in foreign and domestic refining and economics for 20 years. Before his appointment as executive assistant to the president in 1947, he was head of the company's coordination and economics department.

Mr. Shepard became associated with the company in 1927 as a research engineer. Before the war he was engaged in foreign marketing activities of affiliated companies in Europe. During the early part of the war he was appointed Petroleum Attaché for the United States Department of State at the U. S. Embassy in London. On relinquishing these duties, Mr. Shepard returned to Standard Oil Co. (N. J.) to become its representative in the United Kingdom. He was appointed board chairman of Anglo-American in 1945.

Shale Oil In Brazil

Socialist opposition to the concessions granted to private companies for the exploitation of refineries in Brazil has lead a section of the press to reopen the question of distilling oil from Brazil's impregnated shales and schists. One of the largest cotton factories in San Paulo, the Taubaté Industrial, operates with oil extracted from the vast beds of bituminous shales situated at Taubaté alongside the railway from Rio de Janeiro to San Paulo. The neighboring works at Tremembé, belonging to the Companhia Nacional de Oleos Minerals distills 14 to 15 percent, giving 10,500 calories. The installation is locally made and primitive, and production costs are high. The company was founded in 1937 with a capital of $130,000 and holds a concession to exploit 14,500 acres. Working with three retorts, it produces 880 gallons of fuel oil, 265 of diesel oil and 440 pounds of paraffin daily.

The beds were recently examined by a commission of United States experts, led by Albert J. Kraemer, and were pronounced after eight months' study to be among the richest deposits in the world. On the strength of this report the directors of the enterprise, with the approval of the National Petroleum Council, ordered a complete installation from the Foster Wheeler Corp., of New York. It is designed to produce daily 3,300 gallons of fuel oil, 440 gallons of gasoline and 1,320 gallons of diesel oil. The entire output, including the sub-products of ammonia, paraffin, et cetera, will be absorbed within the district.

Other areas containing important impregnated shales exist in Ceara, Alagoas, Bahia, San Paulo and Amazonas, and smaller deposits occur in Goiás, Paraná and Santa Catarina. The first three were examined by the American geologist, Dr. R. Arnold, and reported to be of high commercial value. The shales near Ribeirao Preto, the center of the San Paulo coffee zone, contain 25 percent oil. Those of Maraú, in Bahia, are capable of yielding gas of high illuminating power, each metric ton containing at least three barrels of oil, besides extracts such as benzine and phenol.

FLORENT H. BAILLY, recently elected to the presidency of Pantepec Oil Co., C.A., and Pancoastal Oil Co. C.A., of Venezuela, has been with Pantepec since the beginning of 1928. He has been active in the engineering and geologic departments of the company, and since 1938 has acted as chief engineer and chief geologist. Mr. Bailly is also president of Petroleum Engineering Associates, Inc., and Oil Properties Consultants, Inc., of Pasadena, Calif., petroleum engineering and laboratory firms, which he was instrumental in forming in 1947 and 1948.

F. H. Bailly

Brazilian Refinery

Referring to the refinery to be built in Brazil, under the auspices of the federal government, to process 45,000 barrels of crude oil daily, the president of the National Petroleum Council has announced that the project will be engineered by an American firm and that the principal equipment will be purchased in France. The proposals submitted by the Hydrocarbon Research, Inc., for the design and supervision, and by the French company, Fives-Lille & Schneider, for the equipment have been accepted, subject to approval at a plenary session of the Council. A definite decision will then be taken as to the location of the refinery.

Extension of Rawalpindi Field

A new despatch from Karachi, Pakistan, reports the bringing in of a new well with a daily production of 1,800 barrels, extending Burmah Oil Company's Rawalpindi field in the Punjab. At the same time company operations in the Yenangyuang fields in Burma have been suspended on account of continued fighting in that area.

Visits United States

C. E. Riddell, Middle Eastern representative for United Geophysical Co. S.A., Costa Rica, arrived in the United States the first part of July for his bi-annual vacation.

LUIS HERRERA, recently appointed assistant to the president of the Mene Grande Oil Co., was born in Caracas, Venezuela, in 1906. He received his degree in civil engineering at the Central University of Venezuela in 1929 and a year later joined the Paraguana Petroleum Corp. In 1931 he was appointed assistant petroleum inspector general under the Ministry of Fomento, being promoted a while later to the position of full petroleum inspector general.

In the middle thirties, Mr. Herrera was sent by the government to the University of Texas where he was conferred the degree of chemical engineer in 1938. Upon his return to his country, Mr. Herrera was again appointed petroleum inspector general until early 1943, when a new service centralizing all government offices related to the petroleum industry in Venezuela was created at the Ministry of Fomento under the name of Technical Office of Hydrocarbons. Mr. Herrera was appointed director of the new service. During the year of 1944 in his position of director of the Office of Hydrocarbons, Mr. Herrera was appointed on two occasions Acting Minister of Fomento. In early 1946 he resigned to work with the Mene Grande Oil Co., which he joined as executive assistant.

Luis Herrera

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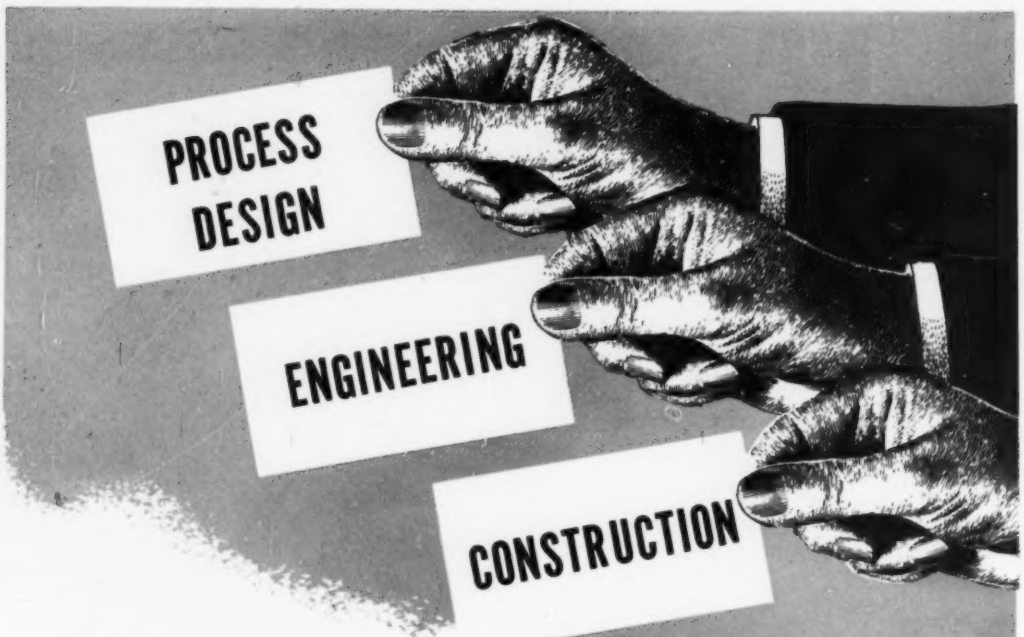

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OIL COMPANY STAFF CHANGES

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W. F. Bramstedt

W. F. BRAMSTEDT has been elected executive vice president and a director of the Caltex Bahrein group of companies as announced by California Texas Oil Co., Ltd., and The Bahrein Petroleum Co., Ltd. Mr. Bramstedt was formerly a vice president of Caltex in charge of crude oil marketing before becoming president of Mid-East Crude Sales Co., Ltd., in Sept. 1948.

JOHN M. LANE, JR., has been appointed marine administrator of Sun Oil Co., succeeding Charles R. Innis, retired. Mr. Lane will coordinate the movements of Sun's fleet to meet refinery and marketing requirements and will have charge of chartering tankers and barges. He will work closely with Charles L. Boyle, manager of the company's marine department, in charge of operations and personnel. Mr. Innis had been with the company almost 40 years at the time of his retirement.

ROLAND V. RODMAN, president of Anderson-Prichard Oil Corp., to succeed the late L. H. Prichard, at a special meeting of directors. Anderson-Prichard owns a major interest in the Col-Tex properties, with a refinery at Colorado, Texas. It has operated the company since 1925.

R. F. BAKER, general manager of the domestic producing department of The Texas Co., has been elected a vice president in charge of domestic producing operations. Mr. Baker has spent 33 years in the crude oil producing department of the company. He succeeds R. Ogarrio who was made chairman of an executive producing committee which will consider crude oil production policy on a worldwide basis. He remains a director and a vice president of the company. A. C. Long, assistant to the chairman was elected a vice president in charge of all foreign operations in the eastern hemisphere. Mr. Long's service of nearly 20 years with the company has been principally in foreign work.

L. H. LINDEMAN has been elected a vice president of The Texas Co. in charge of financial matters. He is succeeded as treasurer by Robert Fisher. Both have been with the company since 1910.

VINCENT V. LINDGREN and B. R. Putnam, Jr., have joined the new product development department of the American Cyanamid Co. Dr. Lindgren, who has been associated with the company for the past three years in its Stamford research laboratories, will devote his time to new product development activities. Mr. Putnam, who has been engaged in engineering development in the company's technical department, will be concerned with market research activities.

Robert W. McDowell

ROBERT W. McDOWELL has been elected president of Mid-Continent Petroleum Corp. He succeeds F. B. Koontz, who has been in ill health recently. Mr. Koontz was elected vice chairman of the board. Mr. McDowell has been with Mid-Continent since 1927, when the company bought the Hawkeye and Black Hawk Oil Companies in Waterloo, Iowa, of which he was president. In 1928 Mr. McDowell was named sales manager and in 1930 was made vice president in charge of sales, becoming at the age of 35 one of the youngest executives in the oil industry. On August 22, 1947, he was elected executive vice president.

T. E. Fitzgerald has been elected vice president in charge of marketing. He has been general sales manager since February 1948, and has been with Mid-Continent since 1947 when he joined the refinery staff as assistant chief clerk in the cost department. Soon promoted to chief clerk, from 1923 to 1926 he performed special engineering and statistical work.

GEORGE W. EVANS, for the past ten years general purchasing agent for Continental Oil Co., has been appointed to the newly created position of coordinator of pipelines and manager of purchasing. S. V. McCollum, assistant purchasing agent, succeeds Mr. Evans as purchasing agent. In his new position Mr. Evans, in addition to having executive direction over purchasing, will coordinate activities of Continental Pipe Line Co. and other subsidiaries or affiliates.

George W. Evans

F. E. POWELL has been appointed deputy general manager of the foreign trade department, Socony-Vacuum Oil Co., Inc. Robert Frothingham will succeed Mr. Powell as chairman of the foreign trade committee. Charles F. Darlington has been appointed as Socony-Vacuum's representative in London. He will succeed C. Victor Barry who is giving up his position because of ill health. C. T. Crawford will become assistant to the general manager and chairman of the planning group of the foreign trade department. Mr. Crawford, who is manager of the supply and distribution division, will be succeeded in that post by L. B. Davis.

H. M. HILL, superintendent of Stanolind Pipe Line Company's Wyoming division, has been appointed manager of the pipeline department of Utah Oil Refining Co. He succeeds J. B. Harshman, resigned. Ray R. Strand, former Stanolind district foreman at Casper, succeeds Mr. Hill.

E. A. SKINNER has been elected a vice president of The Bahrein Petroleum Co., Ltd., and will be in charge of government and public relations in the Persian Gulf, with office in Manama, Bahrein. Mr. Skinner has worked in Alaska, South America, Europe, the Middle East, Netherlands East Indies, Australasia and the Philippines. Until his election as vice president of Bapco, Mr. Skinner had been vice president of Trans Arabian Pipe Line.

ROGER B. JONES has been appointed director of industrial relations for the Sinclair Oil Corp. Mr. Jones, who has for many years been connected with legal department, will make his headquarters in New York.

DR. A. B. BRYAN, chief geophysicist of the Carter Oil Co., has been transferred to the production research department of Standard Oil Development Co. In his new capacity Dr. Bryan will work on the coordination of research activities in the field of oil finding and oil production. He assumed his new position on Aug. 15 at New York.

E. W. RIBLETT has been transferred from the New York office of The M. W. Kellogg Co., to Jersey City, N. J., as associate director of the petroleum and chemical research laboratory.

MILLARD K. NEPTUNE has been appointed manager of the new foreign department of Continental Oil Co. Continental has long been active in Canada through its affiliate, Hudson's Bay Oil and Gas Co., Ltd. Early this year Continental joined with Amerada Petroleum Corp. and the Ohio Oil Co. to form Conorada Petroleum Corp. to extend foreign operations elsewhere. Mr. Neptune spent three years in Venezuela as assistant manager of the Phillips Venezuelan Oil Co. He joined Continental Oil Co. last year. Headquarters for the new foreign department are to be established in New York City.

Millard K. Neptune

F. C. Sealey

F. C. SEALEY has been elected a vice president of The Bahrein Petroleum Co., Ltd., in charge of producing and exploration, with offices in New York. He is also executive vice president of American Overseas Petroleum Co. Mr. Sealey entered the oil industry 32 years ago as a geologist and for the past 11 years has been associated with foreign producing activities.

ALDEN S. DONNELLY was elected a vice president and director of Honolulu Oil Corp., at the recent annual meeting of stockholders in San Francisco. He has been general superintendent of Honolulu's mid-continent division for several years and will now be manager of operations for the division. He has been in the division headquarters in Midland since he joined Honolulu in 1928.

J. G. STEVENS has been elected executive vice president and treasurer of Douglas Oil Co., of Calif. He formerly was vice president and treasurer. Other officers newly elected at the recent annual meeting include: Sam Goldman, vice president in charge of marketing; William F. Lyte, vice president in charge of asphalt sales; John J. Stanko, vice president in charge of research and asphalt specialties; and L. A. Whitlock, vice president in charge of refining. All had been associated with Douglas Oil in executive capacities. D. L. Commons, formerly assistant secretary, was elected secretary; and G. E. Clarke was elected assistant secretary. Earl S. Sharp was made assistant to the president.

C. T. HELM, marketing advisor for Standard Oil Co., (N. J.) for Latin America, has been elected a director of International Petroleum Co., Ltd., Toronto, Canada. Mr. Helm joined the Jersey organization in 1916 and, after 28 years of foreign service during which he resided in most of the countries of Latin America, he returned to the United States in October 1948.

T. C. HUGHES has been elected executive vice president and B. W. Anthony a director and secretary-treasurer of Oronite Chemical Co., chemical products subsidiary of Standard Oil Co. of Calif. Mr. Hughes, who went to work for Standard in 1926, has been with Oronite since its formation in 1943. Mr. Anthony is transferred from California Spray Chemical Corp., another subsidiary.

H. BEN COX of Houston, has been named superintendent of the land-lease department of Cities Service Oil Co. (Del.). He succeeds the late James C. Kennedy, veteran superintendent of this department. Mr. Cox's replacement at Houston has not been named as yet, according to R. L. Kidd, of Bartlesville, vice president and manager of the company's land and geological division.

Shell to Build Gasoline Plant

Shell Oil Co., Inc., will build a 60-million-cubic-foot gasoline plant at Provident City, 75 miles southwest of Houston. The plant will produce 2,400 barrels daily from gas from the Provident City, Hope, Brushy Creek and Englehart fields. Residue will be sold to Texas Eastern Transmission Corp. Contract has been awarded to The Fluor Corp., Ltd.

J. H. Sembower

J. H. SEMBOWER has been appointed to the newly created post of assistant to the executive vice president of Shell Oil Co. He will direct Shell public relations activities on the Pacific Coast. Mr. Sembower joined Shell in 1938 and was manager of the public relations department in New York when he joined the Navy in 1942. On his return in 1946 he became head of personnel, industrial relations and training for Shell's Texas-Gulf Coast area, with headquarters in Houston. He held the post until April 1948, when he was made director of the International Road Federation.

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Exploration Concession in Saskatchewan

J. H. Brockelbank, Minister of Resources in Saskatchewan, has announced completion of negotiations with six United States oil companies covering the exploration and development of 9,000,000 acres of potential oil land in that province. Companies participating in the operations are Tide Water Associated, Atlantic Refining, Honolulu, Seaboard, Barnsdall and Columbia Carbon. The area covered by the permits extends westward from Saskatoon to Biggar and south from Swift Current to Lake Johnston. A second block is situated in the Touchwood Hills area and a third extends from Qu'Appelle Valley south to Carlyle and east to the Manitoba border.

Fentress Named Acting Head of OGD

Following the resignation of Robert E. Friedman as acting director of the Oil and Gas Division of the U. S. Interior Department, which became effective June 15, Carroll Fentress was named as acting director . Mr. Friedman has been acting director of the bureau since the resignation of Max W. Ball on Dec. 1, 1948. He was strongly urged to accept the post of director but decided that after ten years of government service, he must consult his own interests by entering private industry. Mr. Fentress has been the division's director of refining.

New Detroit Manager Appointed

C. Hix Jones has been appointed manager of Detroit district sales for The Youngstown Sheet & Tube Co. He succeeds Robert J. Mullally who has retired. Mr. Jones has been assistant sales manager in the Detroit district since 1935.

Erratum

On page 82 of the June issue an announcement was published dealing with the new factory of Sigmund Pumps, Ltd., at Gateshead, England, and with recent additions to the company's line of pumps. We regret a typographical error in describing the output of the new peripheral pumps. Correct maximum is 50 gpm with heads as high as 300-400 feet with one impeller.

H. T. Brown

H. T. BROWN, secretary-treasurer, Geolograph Co., Inc., Oklahoma City, was recently elected a director of the corporation. Prior to joining Geolograph in 1947, Mr. Brown worked 17 years in geology and engineering with the Cities Service Oil Company.

German Discovery at Ruehlertwist

According to recent production tests, the youngest German oil field, Ruehlertwist, Emsland province, discovered by a well of the Wintershall A.G. some weeks ago, has proved an encouraging prospect. Preliminary tests at the wildcat Ruehlertwist 2 had yielded 8—15 cbm (50-95 barrels) crude oil daily. Now after the deepening of the well, an initial daily output of 46 cbm (290 barrels) of crude oil has been reached by pumping. This is well above the average of wells in the other German fields.

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Baroid Introduces New Filter Press

A new simplified, dead-weight hydraulic pressure unit for use in determining the filtration characteristics of drilling mud has been developed by Baroid Sales Division. The unit attaches easily to the standard Baroid No. 300 filter press and may be purchased as a separate unit and attached to this press without any special alterations or tools.

Establishes Service Point in South America

The Houston Oil Field Material Co., Inc., of Houston, Texas, has organized HOMCO Service, Inc., a western hemisphere trading corporation, with offices in Houston, Texas, and Caracas, Venezuela, which will operate principally in eastern Venezuela. D. U. Skinner will be in charge of operations in Venezuela. He is well known throughout the oil fields there, having spent some two years in the territory with headquarters in Caracas.

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T. B. Herndon

Organizes Venezuela Subsidiary

National Supply Co. has organized The National Supply Co., of Venezuela, C.A., to represent its interests and those of The Oil Well Engineering Co., Ltd., of England in Venezuela. Headquarters of the new company will be in Caracas. T. B. Herndon has been selected as manager of the subsidiary. Mr. Herndon has been a field engineer with National Supply Co. since 1936. Early this year he was appointed division manager at Caracas.

To Lay Products Line

Salt Lake Pipe Line Co., a subsidiary of Standard Oil Co. of Calif., has asked for bids on the initial portion of a 560-mile products pipeline to be built from Salt Lake City into the northwest. First leg of the eight-inch line will extend 320 miles to Boise, Idaho, and will cost $6 million. The line may be later extended to the Columbia River in western Washington.

Petroleum Training for Reserve Officers

The first peacetime school in petroleum engineering for reserve officers of the Armed Forces was held in New York in June under the auspices of the Commandant of the Third Naval District with research and educational heads of leading oil companies conducting the program. One hundred and five selected officer-students of the Navy, Army, Air Force, Marine Corps and Coast Guard Reserves received two weeks of intensive training covering every phase of the oil industry. In addition to the lectures by the industry's specialists, talks were given on military requirements and procedures by members of the Armed Forces Petroleum Board. Health and safety procedures were discussed by oil industry representatives.

Rear Admiral Walter S. DeLany, USN, Commandant of the Third Naval District, welcomed the trainees at the opening exercises. Cooperating in the undertaking were the following companies: Socony-Vacuum; Esso Standard; Shell; The Texas Company; Sinclair Refining Company; Sun Oil Company; Tidewater Associated; Gulf Oil Company; Ethyl Corporation; Sun Shipbuilding & Drydock Company; M. W. Kellogg Company and Foster Wheeler Corporation.

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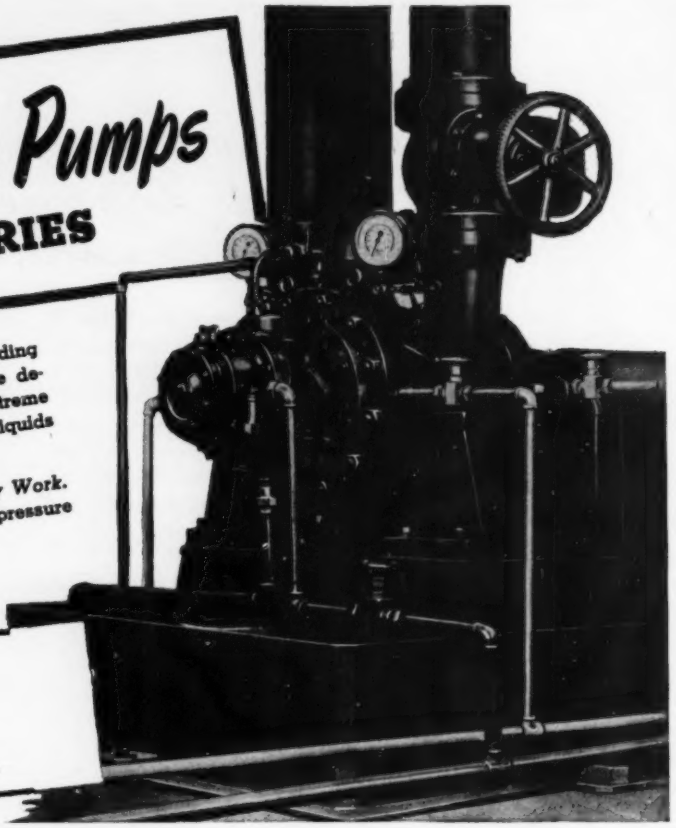

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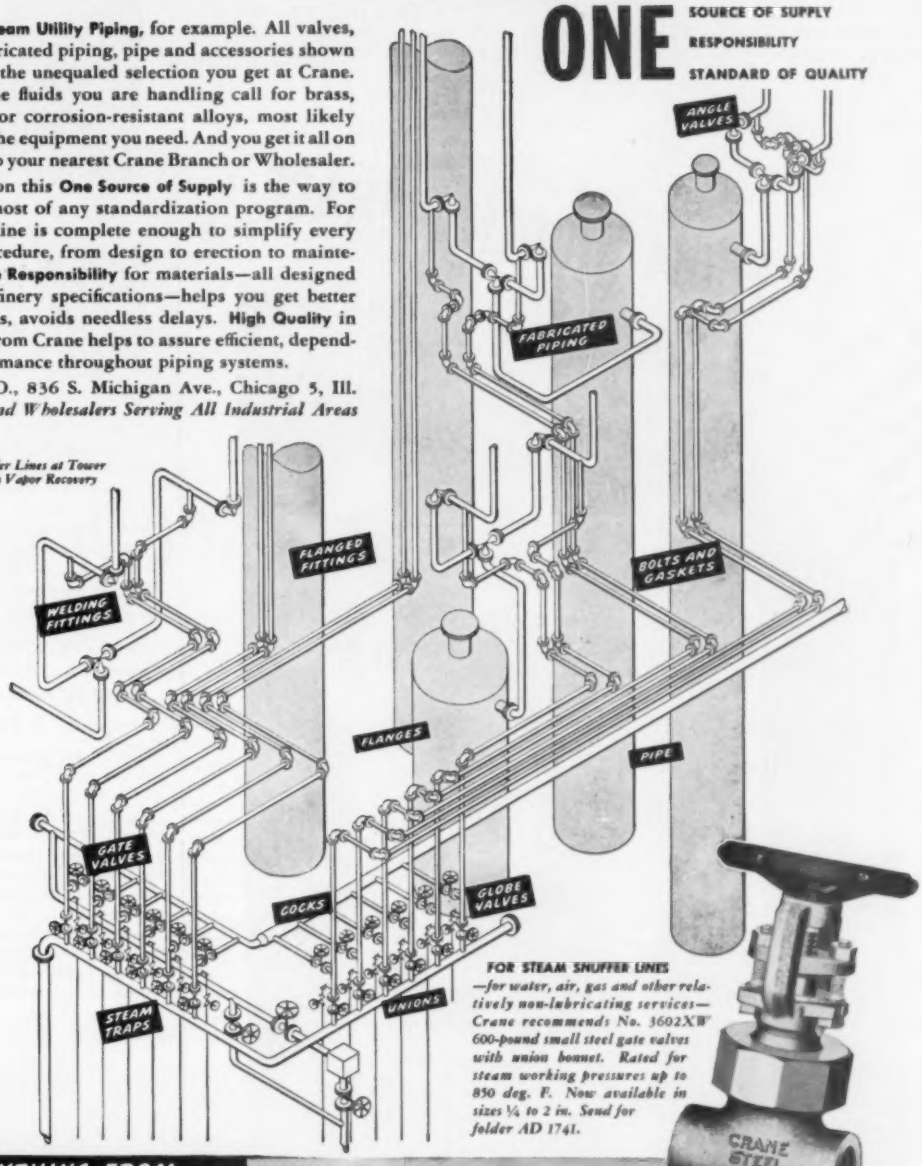

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Robert Haig Retires

Robert Haig, one of the outstanding shipbuilding engineers of America, retired from active service at the Sun Shipbuilding and Dry Dock Co., Chester, Pa., on July 1. Mr. Haig, who was senior vice president of the company, will be 88 years old next November 24. He came to Sun Ship in 1916 and helped to lay out the shipyard on the banks of the Delaware River, supervised the construction of shops and shipways, laid the keel of the first vessel built by Sun Ship.

Mr. Haig was born in Sterlingshire, Scotland, and learned shipbuilding on the Clyde. After several years at sea he became associated with Lloyds and represented that association in America up to the time he was put in charge of the building of vessels at Sun Ship.

During World War II when this plant turned out 250 vessels and 35 large car floats from Pearl Harbor to Oct. 1, 1945, he saw the yard grow from eight to 28 shipways. The peak of employment was in July 1943 when there were 35,633 on the payroll and Sun Ship was rated as the largest single shipbuilding plant in the world.

Move Export Office

Export office of Lee C. Moore Corp., is now located in room 1125 Time and Life Building, 9 Rockefeller Plaza, New York 20, N. Y. G. I. Lynch is export manager.

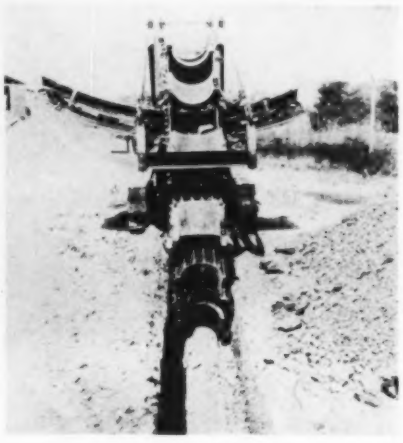
G. E. Wynn

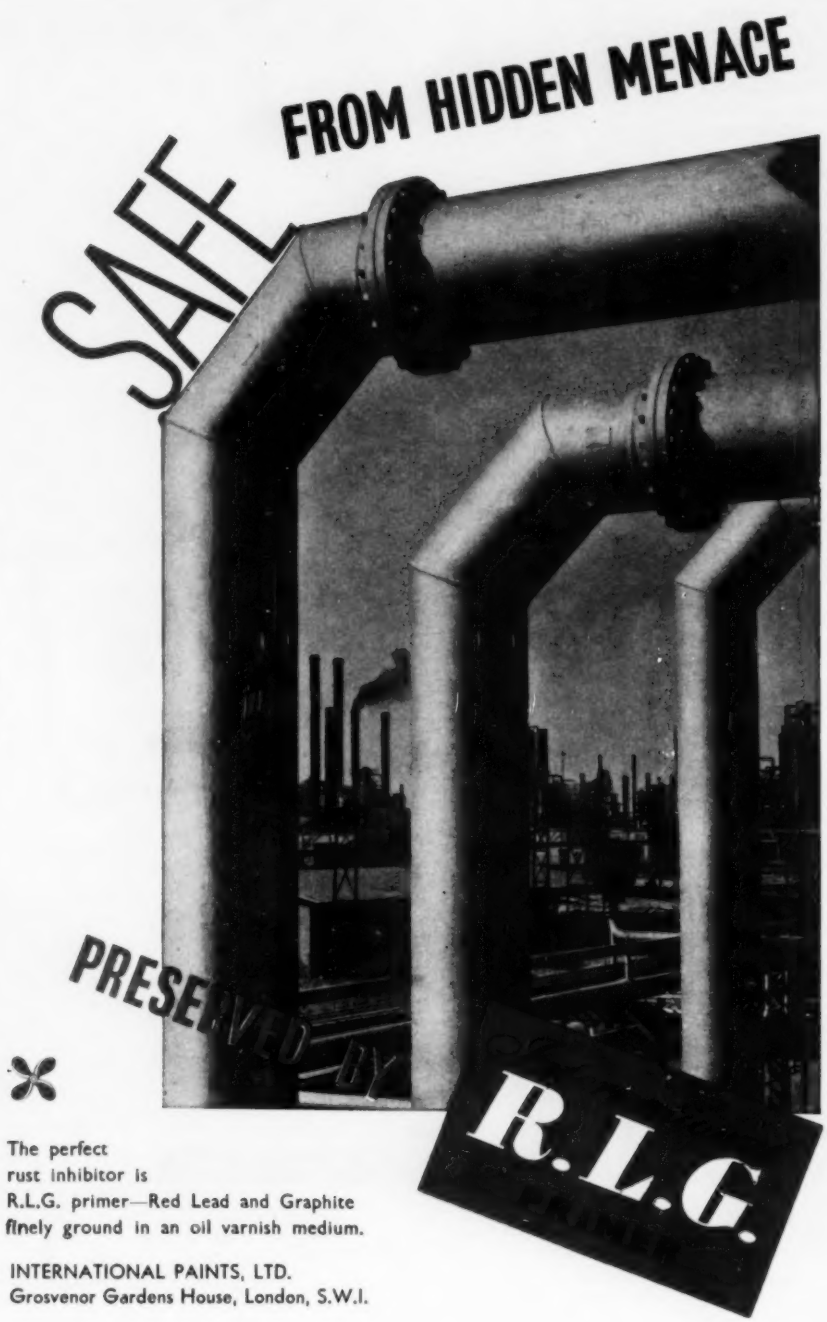
G. E. WYNN has been elected vice-president in charge of manufacturing for Mid-Continent Petroleum Corp., Tulsa. Mr. Wynn joined the company as utility engineer in 1924 and in 1937 was made supervisor of the planning and development department. He became general superintendent of the refinery in 1945.

D. Glenn Morgan, for many years manufacturing manager of the refinery, was elected director of research and development, a newly created department that will have many broad and important responsibilities, including all research and development work, maintenance of specifications of all products and coordination of activities between all departments of the refiner. Mr. Morgan joined the organization in 1917 and has advanced steadily, having filled the positions of chemist, assistant transfer foreman, assistant process superintendent and general superintendent. On February 1, 1945, he was named manufacturing manager.

Pipe-Strippers

Patented stripping buckets for stripping pipe for take-up and repair have been announced by The Cleveland Trencher Co., Cleveland, Ohio. The special buckets are designed for installation on the digging wheel of Cleveland's trenching machines. The buckets permit excavating down to and along both sides of the pipe to at least its horizontal diameter, thus completely freeing the pipe for take-up with no bending damage due to earth bind. The contour of the stripping buckets greatly facilitates their following and staying on the line despite sidebands. Danger of tooth or rooter damage is avoided by the bucket design, which is practically concentric with the pipe being exposed.





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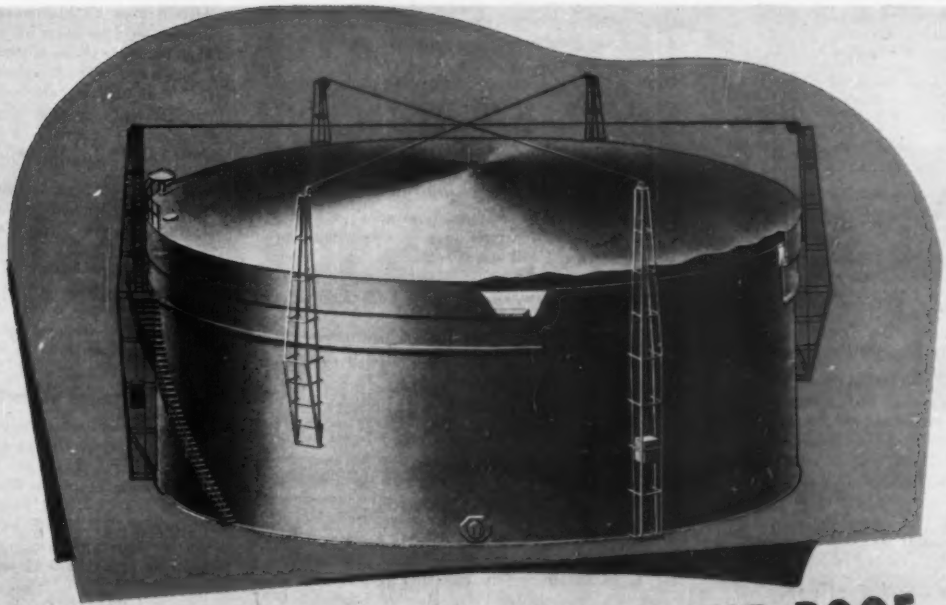

THE WIGGINS DRY SEAL LIFTER ROOF

. . . can be used to conserve the vapors of a single tank, on which it is installed, or it can serve as a vapor balancing unit of several interconnected tanks.

ADVANTAGES

THE SEAL	**1 — 100% dry seal eliminates corrosion, heating and freezing problems.** **2 — No maintenance other than periodic inspection required.** **3 — No possibility of stored product being absorbed in seal and creating a fire hazard.** **4 — Out-of-level tank grade does not affect seal operation.**
COUNTER BALANCE SYSTEM	**1 — Reduces operating pressure to 1¾" water.** **2 — Reinforcement of interconnected tanks not required.** **3 — All mechanism completely accessible from outside.** **4 — Not affected by out-of-level tank grade.** **5 — No lubrication required.**
PRESSURE VACUUM RELIEF	**1 — No leakage, absolutely gastight.** **2 — All working parts outside tank and readily accessible for inspection.** **3 — Simplicity. Single valve serves for both pressure and vacuum relief.**

For further details, write for a copy of Bulletin VB-10.

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Venezuelan Production

Production of crude oil in Venezuela during the month of May amounted to 40,036,551 barrels, an average of 1,291,502 barrels daily. As compared with April, this daily average is higher by 91,518 barrels. Exports for the month were 29,981,103 barrels. Production by companies is shown in the following table:

Company	West	East	Total
Creole	13,387,601	4,653,889	18,041,490
Mene Grande	1,148,676	5,423,592	6,572,268
Shell	12,580,774	—	12,580,774
Sinclair	—	482,963	482,963
Socony	—	1,084,064	1,084,064
Texas	—	215,123	215,123
S.A.P. Las Mercedes	—	482,786	482,786
B.C.O.	31,177	—	31,177
Phillips	—	109,981	109,981
Rexco	121,544	—	121,544
Varco	—	310,287	310,287
Guasare	4,094	—	4,094
Total	27,273,866	12,762,685	40,036,551

Lane-Wells Shifts Export Personnel

Robert Hall, formerly sales engineer in the Los Angeles export office of Lane-Wells, has been transferred to Petro-Tech, Venezuelan subsidiary of the company. The transfer was made to effect closer liaison between the home office and Petro-Tech, and to expedite the shipping of the company's products to users in Venezuela. William Harris replaces Mr. Hall in the Los Angeles export office as office sales engineer. He formerly served as a statistical aide.

Canadian Office for J & L Supply

J. L. Shakely, president, Jones & Laughlin Supply Company, announced establishment of a new store in Edmonton, Alberta, Canada, and a district sales office in Calgary. Manager of Canadian operations is H. L. Wilkins, who was appointed to this position effective July 1, 1949. Mr. Wilkins takes to his new assignment a background of experience in the oil field supply business extending over 30 years, having started as a salesman at Nelagony, Oklahoma, in 1919. For the past two years he has been assistant sales manager.

DR. NORRIS JOHNSTON has been named president of the consulting firm, Petroleum Technologists Inc., Montebello, Calif. He formerly was with the General Petroleum Corp., for 10 years as chief physicist in charge of production research. During this period he was assigned to Socony-Vacuum to set up their Dallas production research laboratories.

United Geophysical Changes Personnel

C. C. Lister, manager of foreign operations of United Geophysical Co., Inc., has been transferred to the United States and will make his headquarters in Pasadena at the home office. C. E. Cowden, formerly party chief in Brazil, has been appointed field engineer in Venezuela with headquarters in Caracas. P. J. Rusch, formerly party chief in Venezuela, has been transferred to Brazil as party chief with headquarters in Aracaju.

Proposed Colombian Refineries

While no official information has been released by the government of Colombia on the report of North American engineers as to the best means of reducing imports of petroleum products, some of its suggestions appear to be fairly well known. One of the recommendations is said to be the installation of a catalytic cracking plant in the refinery at Barranca Bermejo, which the government is to take over at the expiration of Tropical Oil Company's concession in 1951. Another suggestion is the establishment of a refinery at Cartagena to manufacture products for shipment to Atlantic and Pacific coast points. The suggested program is understood to involve an investment of $25 million.

Blaw-Knox Opens Tulsa Office

Chemical plants division of Blaw-Knox Co. has opened a district office at Tulsa, Okla., to provide sales and engineering service to the oil and gas industries of the southwest. Charles E. Barry, of Tulsa, has been appointed chief engineer for the oil and gas department and will have his headquarters in the district office. For the past three years he was employed by Jones & Laughlin Supply Co. as process engineer. Prior to that, he with with Phillips Petroleum as senior process engineer. Carl E. Baird, originally of Dallas, Texas, has been appointed sales representative for the Tulsa office.

Peruvian Production

Production of crude oil in Peru during 1948 amounted to 14,069,098 barrels, reports Foreign Commerce Weekly. This was an increase of 9.93 percent over 1947 but was only 80.5 percent of the record output of 1937. Natural gasoline production amounted to 1,088,553 barrels. Refinery throughput of 11,901,942 barrels was up two percent from the preceding year. Consumption of petroleum products was 6,979,345 barrels or 7.23 percent above 1947.

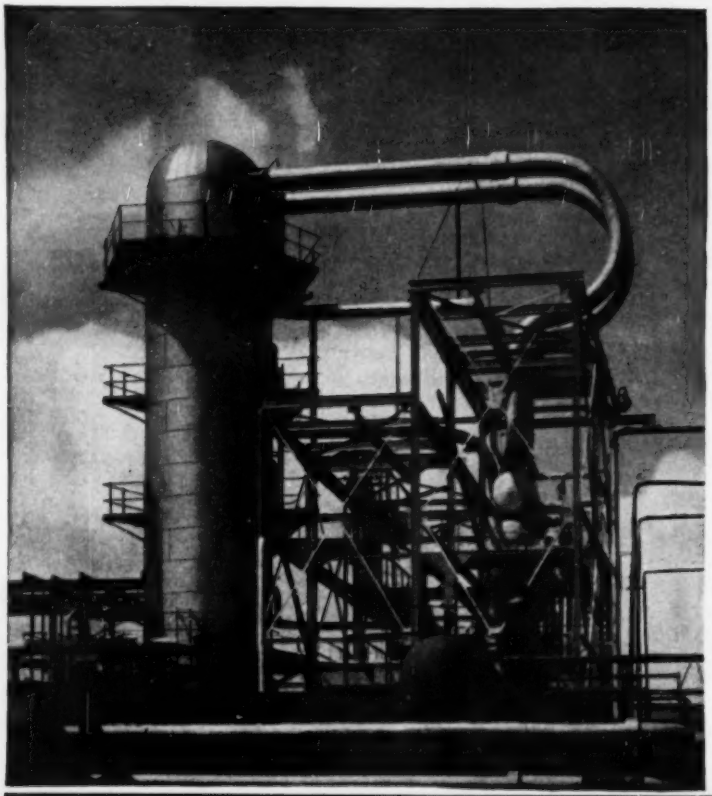
Heads Export Division

B. T. Eagerton has been appointed vice president in charge of the export division of Nordberg Manufacturing Co., Milwaukee. He has been export manager of Nordberg since leaving the Oliver Corporation in 1946.

E. F. SCHWARZENBEK has been appointed director of the petroleum chemical research laboratory of The M. W. Kellogg Co. in Jersey City, N. J.

Opens Export Office

The American Iron and Machine Works Co., has opened an export office at 11 West 42nd St., New York. J. M. Taylor is export manager.



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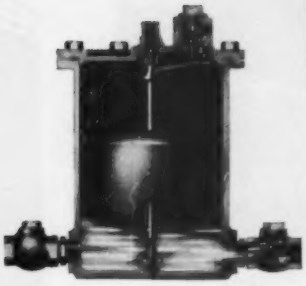

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combines the good qualities of a pressure pump and a vacuum trap. Pumps condensate from low-pressure or vacuum vessels and lifts up to fifty feet; pumps boiling, cold or gaseous fluids (including oils); pumps petrol, benzine, dye liquors and alkaline liquors such as caustic, ammonia, etc.; drains sump holes, pits, excavations (where it may be fully submerged). ENTIRELY AUTOMATIC. *Details of "Ogden's Patent Pump" (in five sizes) from:* OGDEN & CUNLIFFE, (Petroleum Dept.) Charlton House, Cheltenham, Glos., Eng.

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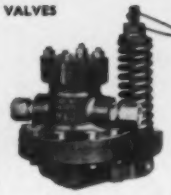
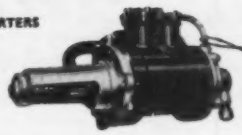


Designed by experts to give a minimum sympathetic pressure drop with variations of upstream pressure. Maximum flow with minimum working drop and absence of pressure creep with no flow. Leaflet No. 43 gives full details.

STARTERS



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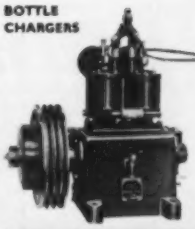

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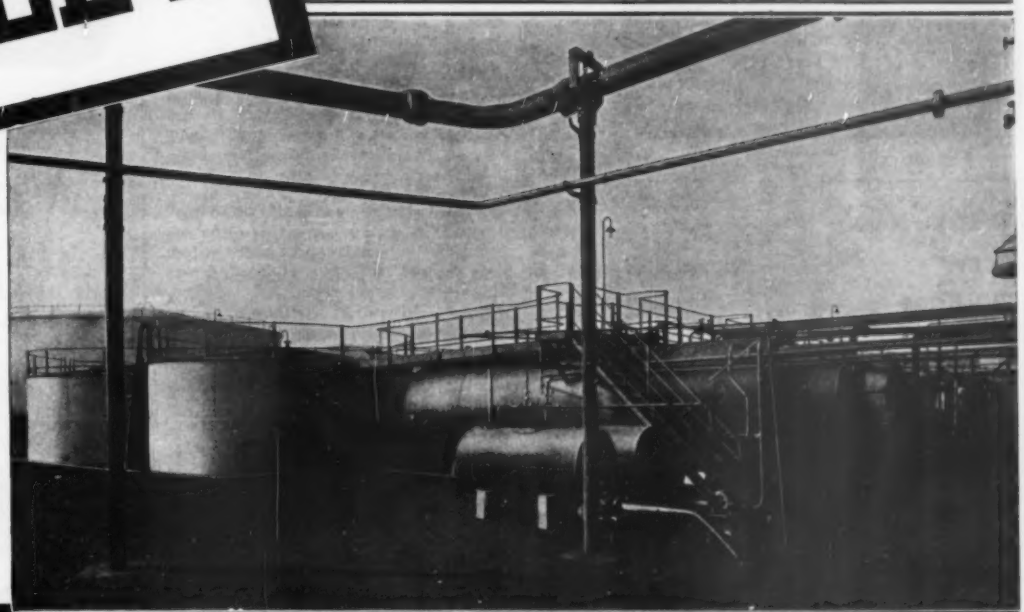
WELDED STORAGE TANKS



Part of a battery of ten, electrically-welded steel storage tanks 9'0" dia. x 30'0" long with tank in background 25'0" dia. x 10'0" deep. Erected at Ellesmere Port, Cheshire. (Photograph by courtesy of Lobitos Oilfields Ltd.)

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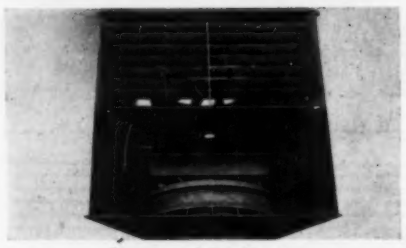

Top view of Fan Housing for a Diesel locomotive.

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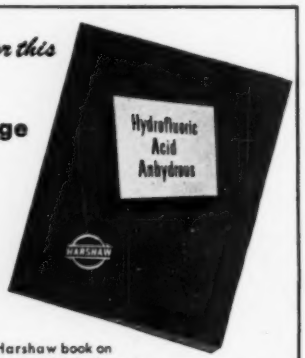

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Halliburton Birthday Party

Celebrating its twenty-fifth anniversary on July 1, the Halliburton Oil Well Cementing Co., of Duncan, Okla., honored 22 veteran employees associated with the firm since its 1924 incorporation. The long-term employees, some of whom came from as far as California for the silver anniversary, were guests of honor at the annual stockholders meeting at Duncan, and were feted at an anniversary luncheon at Duncan's Chisolm Trail hotel.

Erle P. Halliburton, founder and chairman of the company, presented each veteran employee with a diamond-studded lapel pin signifying a quarter-century of continuous service at the anniversary luncheon. The growth of the company was reviewed by Mr. Halliburton at the anniversary luncheon. He traced its expansion from a one-man, borrowed team and wagon enterprise to today's worldwide business with over 4,000 employees.

On June 28 Duncan's civic clubs held an appreciation banquet for Erle P. Halliburton and the cementing firm he founded. It is the town's chief industry.

The Halliburton veterans honored on the company's twenty-fifth anniversary are: J. O. Tillman, Charles Pressly and Allen G. Bell, Wichita Falls; W. A. Wallace and C. C. Hearn, Houston; Frank Kempf, Beaumont; and Hubert Northcutt, Abilene, Texas; Joe K. Verser, Seminole, Okla.; J. E. Lacy, Wichita, Kan.; R. A. Godwin and Elmer T. Thomas, Norwalk, Calif.; R. R. Kelsey, Montalvo, Calif.; J. L. McBride, Shreveport, La., and O. H. Kempf, Shawnee, Okla.; B. O. Johns, Sr., Harry Brigham, W. R. McClendon, T. A. Gilbert Claud A. Murray, Irby B. Cate, William L. Weems, and Dan Thompson, Duncan, Okla.

Herbert Sidney Austin

H. S. Austin, formerly coordinator of pipeline systems for the Standard Oil Co. (N. J.), died as a result of a heart attack on July 5 at Easton, Md. He had been engaged in consulting engineering work with offices in New York since his retirement from active duty with the Jersey company in 1940.

Mr. Austin entered pipeline work in 1911 as an engineer. After various engineering and executive assignments in the United States, he was loaned to Iraq Petroleum Co. in 1930 and served as chief engineer during construction of the 600-mile IPC line from Kirkuk to the Mediterranean. He returned to the New Jersey company in 1935 as coordinator.

Poulin Heads OGD's Foreign Branch

Carroll D. Fentress, acting director of the Oil and Gas Division of the Department of the Interior, has announced the appointment of John A. Poulin, of Kingston, N. Y., to head the division's foreign branch. Mr. Poulin joined the Standard Chemical Co., Pittsburgh, in 1922, as an engineer and chemist. From December 1926 to September 1937 was an engineer and geologist with the Sinclair Exploration Company in Venezuela and Colombia. He transferred to the Texas Petroleum Co. in 1937 and remained in the South American countries until 1943, when in June he was made vice president and manager of the United Geophysical Co. He was later employed as engineering and geological consultant for South America and British West Indies by the Superior Oil Co.

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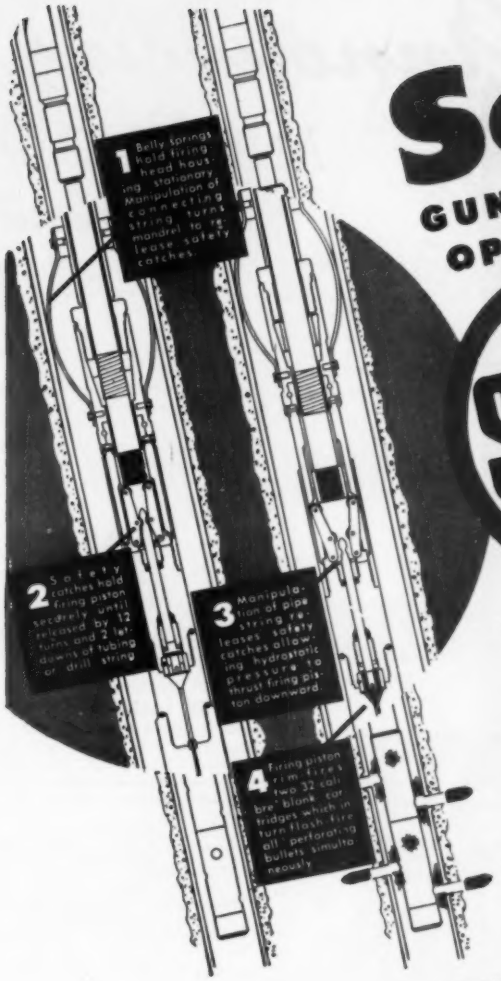
1 Belly springs hold firing head housing stationary. Manipulation of connecting string turns mandrel to release safety catches.
2 Safety catches hold firing piston securely until released by 12 turns and 2 lay-downs of tubing or drill string.
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EXACT POSITIONING in zone to be perforated is determined by actual pipe-in-the-hole tally.

SELECTED NUMBER OF PERFORATIONS is determined by the number of 4, 5 or 6-shot perforating gun body sections attached to the firing-head.

A MINIMUM OF EXPENDABLE PARTS for each perforating job. No extra equipment other than the "SHOOT-N-TEST" Firing-Head, the Perforating Gun Body Sections and a minimum of reloading supplies is needed.

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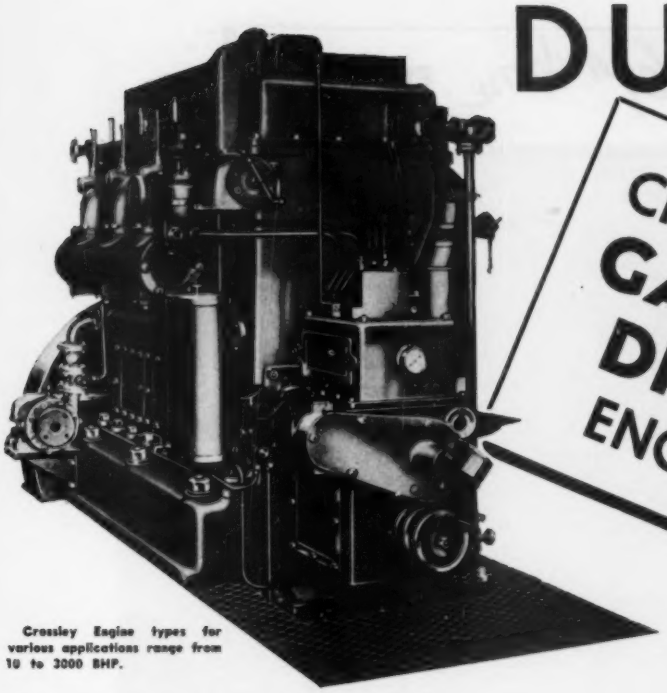
DUAL FUEL

CROSSLEY GAS-DIESEL ENGINES



Crossley Engine types for various applications range from 10 to 3000 BHP.

The illustration shows a three-cylinder 130 BHP—500 RPM Crossley Dual Fuel Engine, designed to use all descriptions of Diesel oils, Town gas, Suction gas, Sewage gas, Natural gas, and Blast Furnace gas.

The change over from one fuel to another is accomplished by simply moving a lever whilst the engine is running. There is no dismantling of parts, thus saving time normally spent in a change over.

The amounts of oil and gas in use can be varied from the very small quantity of oil required for ignition, to any greater quantity up to 100 per cent of oil. This is useful in cases where the supply of gas varies, such as with Natural or Sewage gas.

The Engine is totally enclosed, and marks a big step forward in the convenience with which a change over from Gas to Diesel Oil, or vice-versa can be made.

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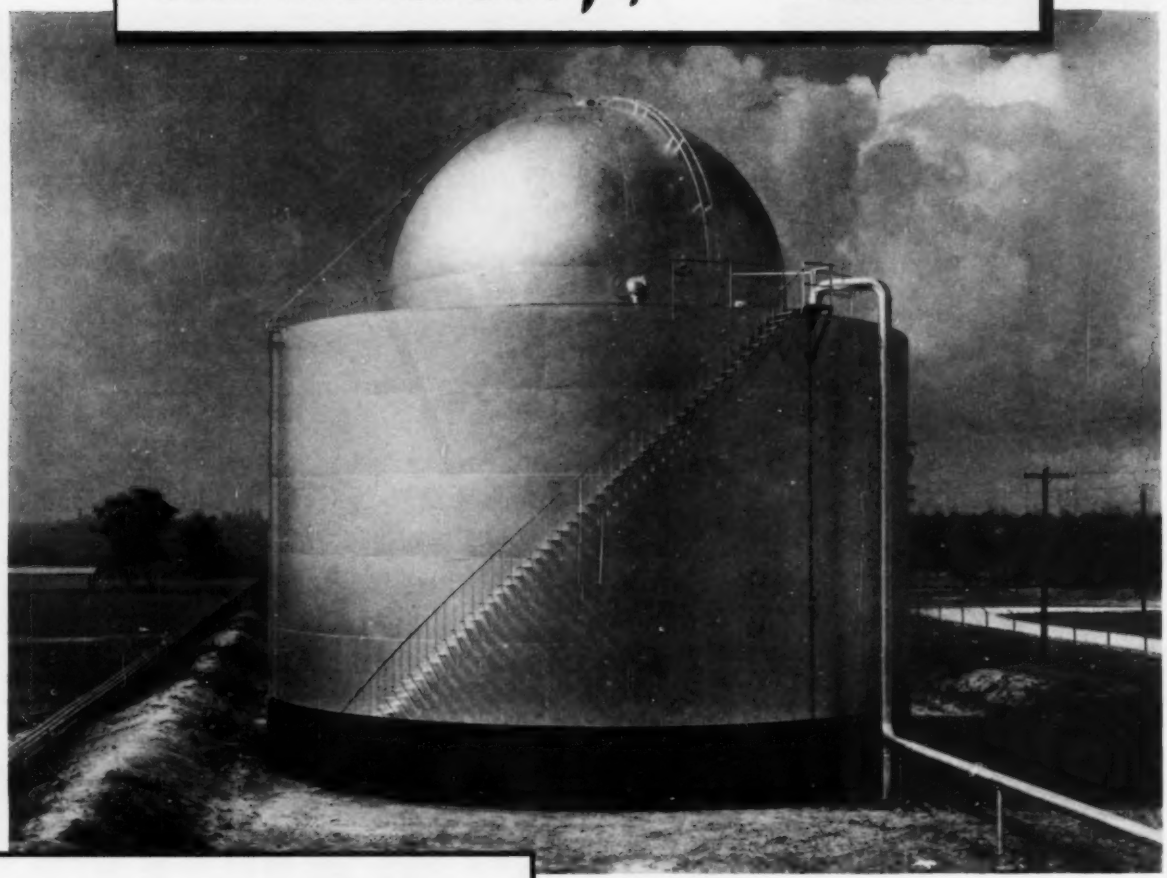

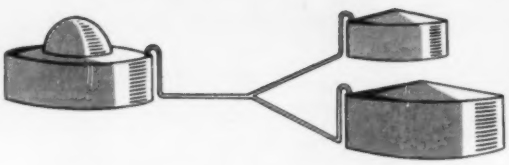

The main illustration above shows a 60-ft. diam. by 40-ft. tank equipped with a 38-ft. diam. Vapordome Roof built for Continental Oil Company at Galena Park, Texas.

The sketch directly above illustrates how a Vapordome Roof is used with cone-roof tanks to form a vapor-saving system. The system operates like this—the vapor-spaces of adjacent cone-roof tanks are connected by large-diameter vapor piping to the expansible vapor space under the Vapordome Roof. A flexible membrane is attached by its outer edge to the equator of the Vapordome. When vapors are displaced from the tanks by breathing or unbalanced filling, this membrane moves upward to provide the additional capacity required. When the atmospheric temperature drops or liquid is withdrawn from the tanks, the membrane drops back down. That's how the Vapordome Roof allows contraction and expansion without venting air and vapor or drawing fresh air into the tanks.

AN EFFICIENT METHOD FOR PREVENTING EVAPORATION LOSSES FROM STANDING STORAGE TANKS

Never before has there been so simple a method for stopping costly "breathing" losses from standing storage tanks as that used in the Horton Vapordome Roof. This simplicity means that you can easily and economically use the Vapordome as the central unit of a vapor-saving system and get reliable protection at low cost.

This economical protection is made possible through the efficient action of the vapor-saving membrane in the Vapordome Roof which operates by natural forces alone—no delicate control mechanisms of any sort are needed. Another economy feature lies in the fact that the Vapordome is easily installed as the roof of either a new tank or an existing tank and does not require additional ground space.

Complete vapor-saving systems can easily be built around a tank with a Vapordome Roof. These systems can be formed without taking existing tanks out of service and additional tanks can be added as long as the Vapordome Roof has sufficient capacity to handle their vapor displacement. Write for Bulletin D for information on how you can prevent evaporation losses with the Horton Vapordome Roof.

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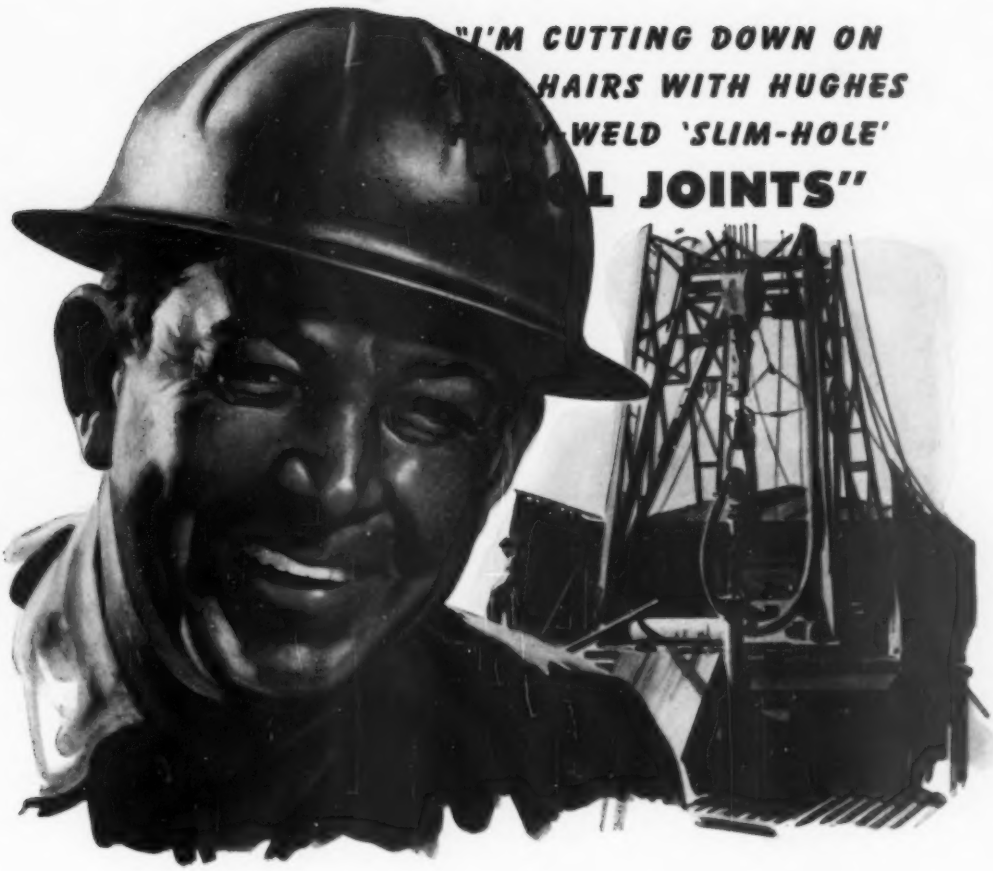

"For my money the Hughes flash-welding process has made the 'slim-hole' type of drill stem, practical. This connection design develops the full strength of pipe, and no 'bore-restricting' pipe to tool joint threaded connections are needed . . . it's another example of a Hughes 'Engineered Solution' for every drilling problem."

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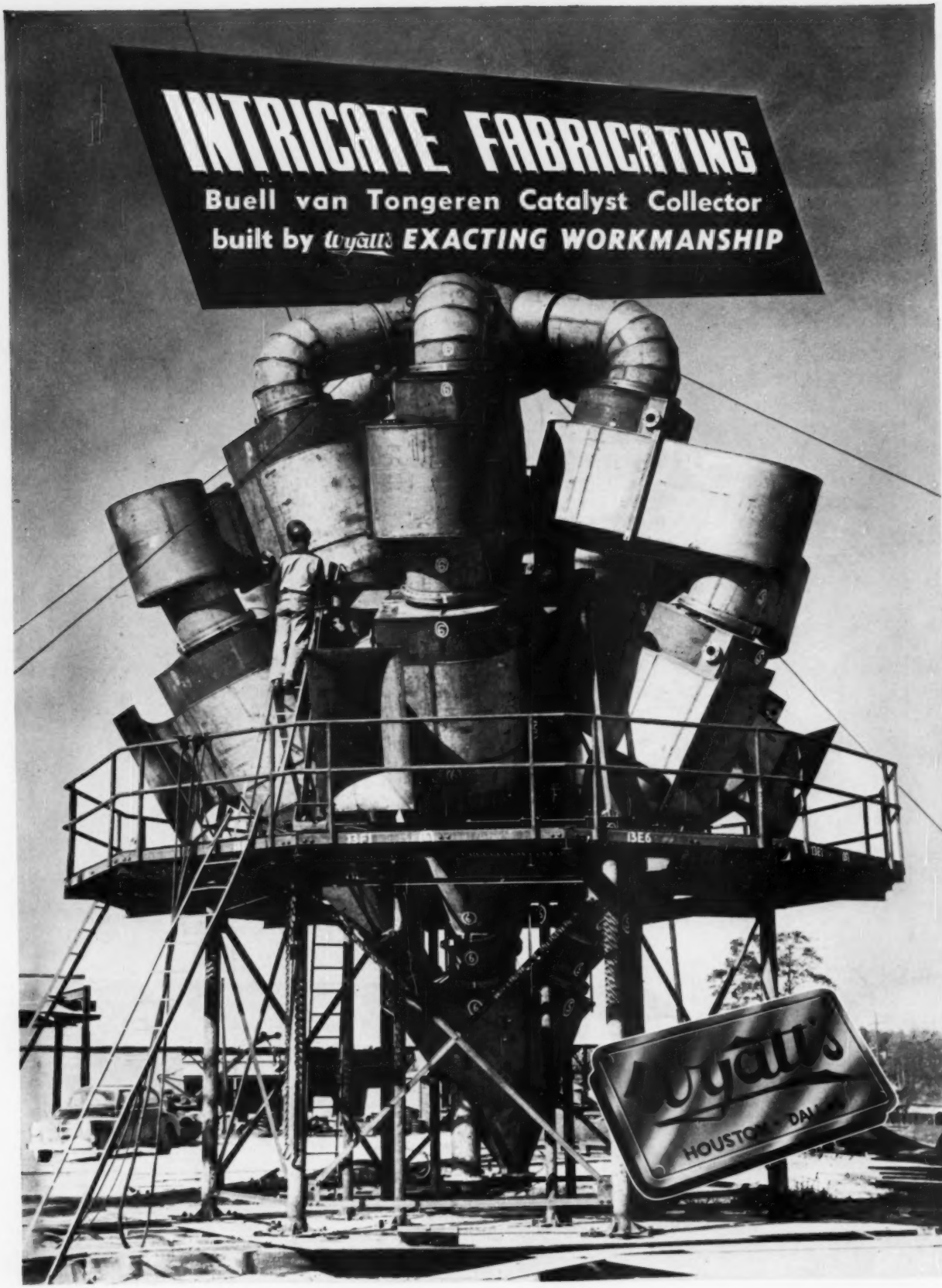
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